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L. M. Fletcher

Trinity College, Cambridge
1899.

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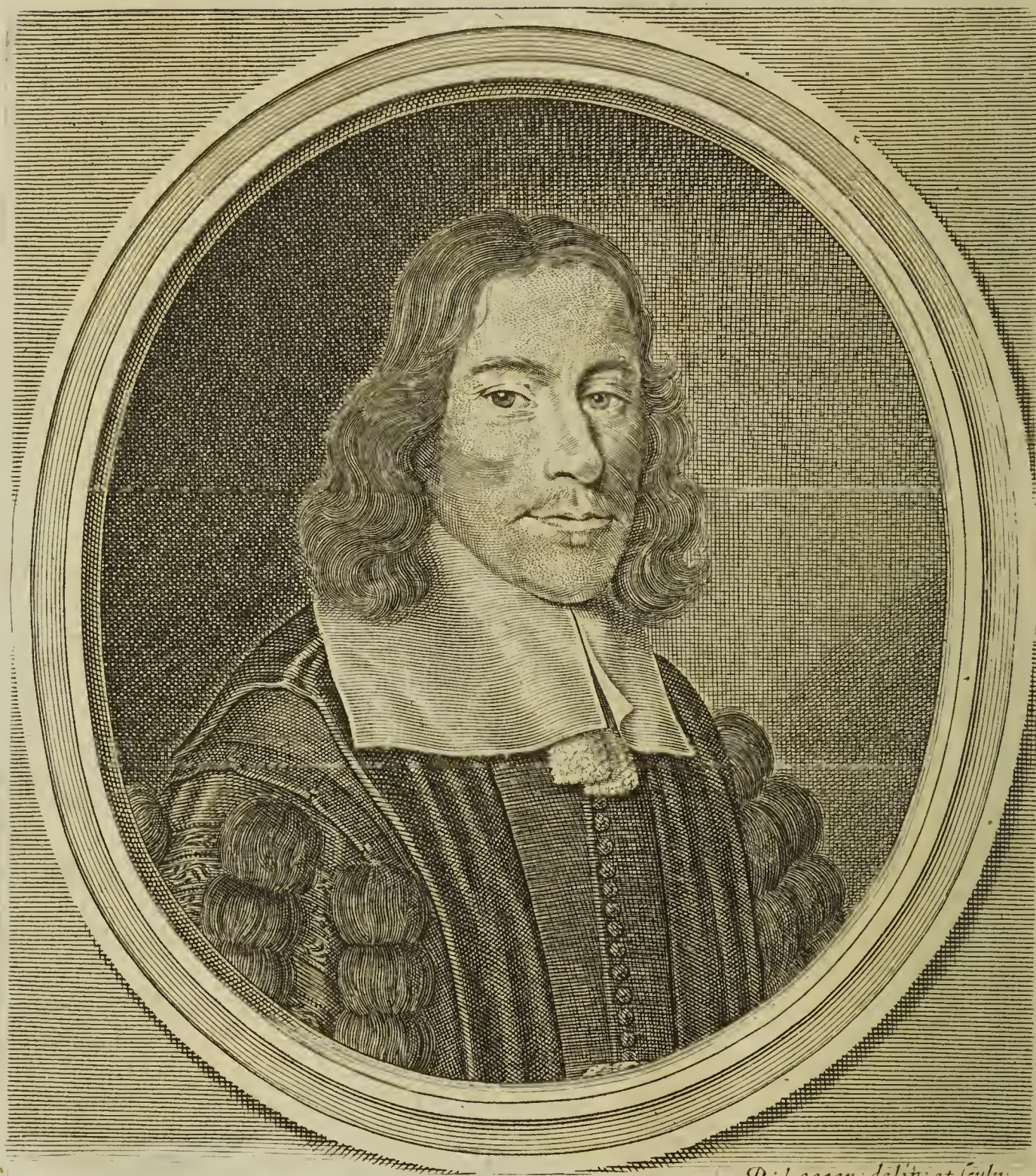
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— M. Currie —





24-10-1912



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THE
REMAINING
MEDICAL WORKS
OF THAT
FAMOUS and RENOWNED
PHYSICIAN
Dr Thomas Willis

OF

Christ-Church in OXFORD, and *Sidley* Professor of
Natural Philosophy in that famous UNIVERSITY.

VIZ.

- I. Of Fermentation.
- II. Of Feavours.
- III. Of Urines.
- IV. Of the Accension of the Bloud.
- V. Of Musculary Motion.
- VI. Of the Anatomy of the Brain.
- VII. Of the Description and Use of the Nerves.
- VIII. Of Convulsive Diseases.

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are to be sold by Robert Clavell, at the Peacock in S^t Paul's
Church-Yard, MDCLXXXI.

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Printed by T. D. King, 11, Abchurch Lane, London, E.C. 4.

TO THE
RIGHT WORSHIPFUL
S^r Theophilus Biddulph
KNIGHT and BARONET.

Honoured Sir,

I Have presumed to Dedicate these my labours to you, being the Translation of a most Worthy and Learned Author, Dr. Tho. Willis his Works, out of the Latine into our Mother Tongue, for the benefit of my Country-men: and knowing you have always been a general, and generous Patriot, a lover of your Country, and of all manner of Industry and Ingenuity, I question not, but you will kindly receive this my Dedication; though not for my sake, yet for the many admirable things that may be found in the Book it self, and for the good and benefit, which this my laborious task may bring to the publick. As I doubt not of your innate Goodness, having already had some particular experience thereof, so I shall no ways fear an unkind reception: And although I launch not into the sea of your Praises, as is the late custom of Dedicators to do, I am perswaded, that this my plain Epistle will be as kindly accepted; for I know you to be so modest a Man, as not to love to see all your good Actions, Virtues and worth, Rhetorically painted and laid open before your Eyes: for as your Worth is too well known, this way to receive any addition; so the praise thereof being needless, will rather cause you to blush, than be any ways pleas'd. But yet I cannot forbear to take notice to the World, that your whole Life has

The Epistle Dedicatory.

been a true pattern of Loyalty and Religion, which in these troublesome and distracted times, may be worthily related and mentioned, as a praise-worthy Example for others to imitate and follow: and that you are both a true lover of the Church of England, your King, and Country, which you have eminently shew'd in all your Actions, and manifested to the World, by your several publick Employs, in the behalf of your Country, and of the Renowned City of London, of which you are a most worthy Member. And no doubt, but that it is for this your stedfastness in Religion, your Loyalty to your Prince, your Love to your Country, and your uprightness in your Dealings, that God hath showered on you all manner of external Blessings, giving you a fair Estate, through your own Industry, Wisdom, and Prudence, a Virtuous Consort, and a prosperous Issue, the fair and flourishing Branches of your Ancient Stock and Family: To all which outward felicities, I shall pray, That God may also indue your noble Soul with the Celestial and Eternal Blessings and treasures of the World to come, and that you may be constantly happy both here and hereafter. I remain,

Honoured Sir,

Your most humble

and faithful Servant,

S. PORDAGE.

A
Medical-Philosophical Discourse
O F
FERMENTATION
O R,
Of the Intestine Motion of
PARTICLES
I N E V E R Y
B O D Y.

B Y
Dr. *THOMAS WILLIS* of Christ-Church in
Oxford, and *Sidley* Professor of Natural Philosophy
in that Famous University.

Translated into English by *S. P.*

L O N D O N :

Printed for *T. Dring*, *C. Harper*, *J. Leigh*, and *S. Martin*.
MDCLXXXI.

TO THE
Most Reverend Father in Christ
And the Right Honorable
HIS GRACE,
GILBERT:

By Divine Providence Arch-Bishop of *Canter-*
bury, Primate and Metropolitan of all *Eng-*
land, and one of His Majesties most Honorable
Privy-Councillors.

Most Holy Prelate,



THE Eagle will not acknowledg his sus-
pected Chicken, by one only sign, for it is not
enough that it can look against the light,
unless it be able also to behold the Sun's
Beams without winking: and indeed al-
tho this our hasty issue, whether by the help of its own
blindness, or of that doubtful light in which it liv'd,
hath been able to come abroad, yet it hath not sufficiently
given marks of its true race, until it might delight its
Eye with your brightness as at the Sun's Beams.

These Meditations or Discourses tho several times
published, now therefore at length boast, that they are
able to shew themselves to the light first, with your Sa-
cred name in the front, it is then but reason, that the
same Mecænas, who hath brought me forth into the open
light, from my own darkness, and from the filthiness, and
soot in which I was involved, being condemned among the

A 2metals;

The Epistle Dedicatory.

metals; should think not it any detraction, to lend to my Works Ornament, and Splendor, as well as to the Author and Publisher.

It was by your means (most Noble Prelate) that I obtained the Votes in this Famous University for the place of Sidly Professor, for how small soever my Merits might seem, they were helped by the greatness and weight of your opinion.

I am exceeding conscious to my self, how unfit, being destitute of all help, I came to that Province, both for the Dignity of the Place, of the University, and of my Mecænas, yet I believe nothing is to be despair'd of, under so great Auspices. I would therefore, if there be any thing, at any time, more happily thought of, in the scrutiny of Nature; and brought forth by me, that it be not referred to my Ingenuity, or (which I might perhaps more truly deserve) my Industry, but to the Influences of my Patron: For to him only he Dedicates and Consecrates himself and all his, who is

Your Graces most humble

And for ever obliged

Servant, T. W.

THE PREFACE.



THE same thing happens to me, about to speak of Fermentation, that once did to a Famous Historian, when he wrote his Commentary of the *Roman* Empire, to wit, whilst he endeavoured to draw forth, as it were in a little Table, the affairs only of that Nation, he was necessitated not only to recount the Actions of one people, but of all man-kind: in like manner, whilst I did meditate on a few things only concerning the energy, and the means of the working of Ferments, I have brought into this Tract, as it were swelled up with a certain Ferment, the whole Provision, and Dowry of all Nature. Entering upon this Disquisition, I thought I had been tyed only to the Bakers Oven, and Brewers Furnace, being condemned to the Mill, not to have proceeded beyond their limits, unless by chance, or with leave; but after that I had begun to look more deeply into the matter, I perceived I had gotten a far more large Province: Because it plainly appeared, besides these of Art, very many Works of Nature, to be not only like, but themselves the effects of Fermentation: For when, for the solving of the Phœnomenas, which are met with about the swelling up of the mealy Mass, and the working of Wine, and of other Liquors, I had Composed divers Arguments, Reasons, and Hypotheses, I found at length, those first begotten Particles, by whose Orgasm or Heat, those vulgar preparations do Ferment, to beget the Causes of motions, and alterations, in whatever things they are mix'd with besides; wherefore, I may be pardoned, if I have strayed far from our proposition, and have seemed to any one, to have heaped together here, too plentiful an Harvest of Matter, because I was wholly led by the same thrud of Ratiocination, and the most conjunct Affinity of things, to these various and diverse Concretes. If any one shall object,

The P R E F A C E.

ject, that I prostitute the unusual Notions, and almost only heard of, in the Shops of the Chymists, unhandsomly among the works of ordinary people, I say, these Principles, which being brought indeed to perform the self moving motions of Natural things, also more easily to represent them to the vulgar capacity, and lay them not only before their Eyes, but even into their very Hands; what of these kind of substances, I call Particles, men tho rude and unskilful, may perceive even by the help of their senses to be in the things: besides the names of Sulphur, Salt, and Spirit, and the rest, are more familiarly known, than Matter, and Form, or the four Principles of the *Peripateticks*. As to our method, and manner of Philosophizing, no man can blame me, if I should not here describe all things according to Rule, and Analytick Patterns; because in this Work, it chances for me to wander, without a Guide, or Companion, in solitary places, and as it were in a solitude trodden by no footsteps, where I not only make a Journey, but my way also: therefore, when ever I deviate, I cannot be said to err, among right Judges of our endeavours, who have no Path in which I should Walk, nor could find a Track, which I might fear to miss.

ON

ON THE
AUTHORS

Medical-Philosophical Discourses.

THE intricate and hidden cause of things,
Both Peace and Strife by what means Nature brings,
What various motions Bodies do inspire;
What mixes with the Waters quenchless Fire?

What Bonds the Elements together tie,
Before this happier Age unfolded lye:
Things hid to former Ages, and unknown,
The Secrets of the world to all are shown.

Metals dug from the Bowels of the Earth,
Tho they from Phæbus boast their Heavenly birth,
We without light, dark and obscure behold,
And Splendor's found only in burnisht Gold.
Iron unknown lay hidden without light,
By Slaves wrought from the Mine grows dazeling bright.
This to whole Troops confusion doth afford,
Wit, which first fram'd, stoops to, the Victor Sword.

We thus of old did Nature search in vain,
Our Arts did only it's outward bark remain,
But now we her hid mysteries unfold,
And the great secrets of the world behold.
Better than us, herself can hardly tell,
What Love doth far within high Mountains dwell.
What flame first gives the Marble Quarry birth;
To Metals forms blind Rudiments of Earth,
And the hard child doth to perfection bring:

Why Earth shows her rich Treasures in the Spring;
And shines, made brave with her own Native flowers.
What gentle gales, and what sweet moistning showers,
Do on the pregnant Goddess Seed bestow;
Whilst Heavenly Iris mounts the Cloudy Bow.

The P R E F A C E.

*Why Ceres swells with watery Nymphs embrace,
What Strife, what Wars spring from hot Bacchus race :
What Vulcan doth th' Ætnean Fornace blow ;
What doth soft fires thorow all Bodies throw.
What Spirit nimbly moves the human frame :
Whence Milky juice here, there a Purple stream,
Watering the Body : whence the Crimson flood ;
And the quick Circulation of the blood.
What hidden fires in veins and intrals burn,
Which do the boyling Blood to Feavers turn.
What mixes freezing cold with parching heat,
And makes the different Zones together meet.
Whence comes the Pestilence with Stygian breath,
Riding on blasting Winds, and arm'd with death.
What Prophefying Humor through the Reins doth pass,
What colour, and what odor in the Glasse ?
All things lye open now : He did not know
So much, to whom Prometheus did bestow
His stollen fires : We now every part
Of the whole Earth compass about with Art.
He's happy who Causes of things can shew ;
Sacred to Nature and to Phœbus too ;
About his Temples Delphic Laurels spread,
And flames of lightning ne'r shall blast his head.
Whom Hermes doth with Sacred Arts imbue,
Whose Labours, Learning out of Darkness drew,
May all's days happy be, may he shine bright,
And may he still enjoy Cælestial light :
May no Disease infect with poysonous breath,
Him, who gains Health from Sicknes, Life from Death.*

O F

FERMENTATION,

O R T H E

Inorganical Motion

O F

N A T U R A L B O D I E S.

C H A P. I.

Of the Principles of Natural things.



Here is nothing more rarely to be met with, in the Vulgar Philosophy, where Natural things are unfolded, with the vain figments of Forms and Qualities, than the word *Fermentation*: but among the more sound (especially of later years) who respect the Matter and Motion chiefly in Bodies, nothing is almost more usual. But Fermentation hath its name from Fervescency, as Ferment from Ferviment or growing hot. The word is well known in making of Bread, and in the purgings of new Wine, Beer, and other potable Liquors: thence it is also applied to other things, which are wont to swell or grow turgid, after the same manner: that at length it signifies, whatsoever Effervency or Turgency, that is raised up in a Natural Body, by particles of that Body variously agitated.

Bodies of a divers Consistency and Habitude, are apt to a Fermenting, *viz.* either Thin or Thick, Liquid or Solid, Animate or Inanimate, Natural or Artificial; in all which is found an Heterogeneity of parts or particles, to wit, there are in them some substances light, and always endeavouring to fly away: and also there are others thick, earthy, and more fix'd, which intangle the subtil Particles, and detain them in their Embraces, whilst they endeavour to fly away; from the strivings, and wrestlings of these two twins, in one Womb, the motion of Fermentation chiefly proceeds; but on the contrary, what things do not Ferment, for the most part consist of like Particles, and are of the same Figure and Conformation, which indeed consociat among themselves, without any Tumult or Turgescency, lye quiet, and enjoy a deep peace. If Must, or new Wine, or new Ale or Beer, be closely Bottl'd up, or put into Vessels of small vent, they will grow so very hot, that often the Vessels are in danger of breaking. But if the same Liquors, being Distilled by themselves, and then what is separated shut up, from thence no motion or heat will follow. Wherefore, Distilled Waters, hot Spirits, Oyls, fixed Salts of Herbs, and very many other more simple preparations of the Chymists, remain a long while

without any alteration or Fermentation, Perhaps some of the Particles do evaporate, but the rest do not tumultuate. In the mean time the juice and blood of Vegetables or Animals, as also all Liquors Concreted, and compounded of many things, quickly Ferment, and from thence enter into divers turns of changes. The Spirit of Wine being closely shut up in a Phial shews no sign of growing hot, but if but a little Oyl of Turpentine be added to this Spirit, the Particles of the Liquor will so leap forth, that I have seen it break a Glass Hermetically Sealed. All Distilled Waters of Herbs, so they be kept simply in a Glass, will remain incorrupt a long time, but if you add to the same Sugar or Syrrup, it presently grows soure and is corrupted: Wherefore, that the Fermentation of Bodies may be rightly unfolded, we must inquire, what those Particles or Substances are, and of what Nature of which mixt things are Compounded, and from whose being put together, and mutual strivings, motions for the most part naturally proceed.

Altho there be many and divers Opinions of Philosophers concerning the beginnings of Natural things, yet there are three chiefly deserve our Assent, and Faith, before the rest. That famous fourfold Chariot of the Peripateticks obtains the chief place, which emulous of the four wheel'd Coach of the Sun, is hurried by a quick passage, through the fictitious Heaven of the first Matter, and measures that vast and empty thing, with a perpetual reciprocation. For they say, all things are Constituted out of Water, Air, Fire, and Earth; and that out of the divers transposition of these, Generation and Corruption, as also the changes of all alterations whatsoever, do arise. In the second place, and next, stands the Opinion of *Democritus* and *Epicurus*, which lately also hath been revived in our Age, this affirms all Natural effects to depend upon the Conflux of Atoms diversly figured, so that in all Bodies, there be Particles Round, Sharp, Foursquare, Cylindrical, Chequer'd or Streaked, or of some other Figure; and from the divers changes of these, the Subject is of this or that Figure, Work, or Efficacy. The third Opinion of the Origination of Natural Things, is introduced by Chymistry, which, when by an Analysis made by Fire, it resolves all Bodies into Particles of Spirit, Sulphur, Salt, Water, and Earth, affirms by the best right, that the same do consist of these. Because this Hypothesis determinates Bodies into sensible parts, and cutts open things as it were to the life, it pleases us before the rest.

As to the four Elements, and first Qualities from thence deduced, I must confess that this Opinion doth something help for the unfolding the Phænomena of Nature, but after so dark a manner, and without any peculiar respect to the more secret recesses of Nature, it salves the appearances of things, that 'tis almost the same thing, to say an House consists of Wood and Stone, as a Body of four Elements. The other Opinion, which is only a piece of the *Epicurean* Philosophy, forasmuch as it undertakes Mechanically the unfolding of things, and accommodates Nature with Working Tools, as it were in the hand of an Artificer, and without running to Occult Qualities, Sympathy, and other refuges of ignorance, doth happily and very ingeniously disintangle some difficult Knots of the Sciences, and dark Riddles, certainly it deserves no light praise: but because it rather supposes, than demonstrates its Principles, and teaches of what Figure those Elements of Bodies may be, not what they have been, and also induces Notions extremely subtil, and remote from the sense, and which do not sufficiently Quadrate with the Phænomena of Nature, when we descend to particulars, it pleases me to give my sentence for the third Opinion before-mentioned, which is of the Chymists, and chiefly to insist upon this in the following Tract, to wit, affirming all Bodies to consist of Spirit, Sulphur, Salt, Water, and Earth, and from the diverse motion, and proportion of these, in mixt things, the beginnings and endings of things, and chiefly the reasons, and varieties of Fermentation, are to be sought. If any one shall object, That the Atomical, and our Spagyric Principles, are altogether subordinate, to wit, that these, tho at the last sensible, are resolved into those, only to be signified by Conception; I shall not much gainsay him, so it shews that those Conceptions are real. I being dul and purblind, leave the more accurate to quick sights, being content to be so wise as to perform the business of the outward Sense with Reason: for I profess, it pleases not me, to devise or dream Philosophy. But that our Work may more rightly proceed, it will be necessary, to speak first a few things of these kind of Principles in general, and of their Affections.

I mean by the name of Principles, not simple and wholly uncompoundd Entities, but such kind of Substances only, into which Physical things are resolv'd, as it were into parts, lastly sensible. By the intestine motion, and combination of these, Bodies are begot, and increase: by the mutual departure and dissolution of these one from another, they are altered, and perish. In the mean time, what Particles are gathered together in the subjects, or depart away from them, will appear under the form of Spirit, Sulphur, Salt, or of one of the rest.

C H A P. II.

A description of the Principles of Chymists, and the Properties and Affections of them.

1. **S**pirits are Substances highly subtil, and Ætherial Particles of a more Divine Breathing, which our Parent Nature hath hid in this Sublunary World, as it were the Instruments of Life and Soul, of Motion and Sense, of every thing; whilst they of their own Nature are always enlarged, and endeavouring to fly away, lest they should too soon leave their subjects, they are bound sometimes with more thick Particles, that by entring into them, and by subtilizing them, and variously unfolding them, they dispose the substance to maturity, as is to be observed in the Vegetation, and Fermentation of Bodies; sometimes being restrained within some spaces, to wit, the Vessels or Bowel of living Creatures, they are compelled more often to repeat the same measures of their motions for the performing the works of Life, Sense and Motion. From the motion of these proceed the animation of Bodies, the growth of Plants, and the ripening of Fruits, Liquors, and other preparations; they determinate the Form and Figure of every thing, prefixed as it were by Divine designation: they conserve the bonds of the mixture by their presence; and open them, by their departure, at their pleasure: they bridle the irregularities of Sulphur and Salt. The perfection and state of every thing consists in the plenty and exaltation of Spirits, and the fall and declination, in their want and defect.

As to the Subjects in which the Spirits are: Minerals because they are of a more fixed nature, wanting Motion and Vegetation, are almost without Spirits, or at least are contented with a few. For the birth and growth of Vegetables, they are required in a more moderate quantity. In the Constitution of a living Creature, where there is greater Use of Spirits, for Sense and Motion, a far more plentiful quantity is found. In the works of Art, and chiefly in those which ascend to perfection, by Digestion and Fermentation, there are found to be a sufficiently great proportion of Spirits: but in all subjects whatsoever, whilst the immerfed Spirits are mingled with the other Principles, their condition or state comes under a threefold consideration: for they are either depressed and scattered, and so involved with more thick Particles, that they are very little seen, or shew forth their powers, as in things undigested, crude and unripe, may be perceived, in which the Spirits can hardly extricate themselves into motion, and from which they can hardly be drawn by Distillation. Or secondly, the Spirits flying forth from the thick substance of the rest, are full of vigor, shake and rightly dispose the more gross Particles, subtilize the thick, digest the crude, and bring things to the steme or height of maturity and perfection: or lastly, Spirits having obtained the height of things, do luxuriate and make excursions out of the Body: hence those that remain, are by degrees lessened of their plenty and strength, until being less in power than the Particles of the Salts and Sulphur, they are put under their yolk, and by little and little are destroyed and driven away out of the Subject; on this threefold state depends the beginnings or rudiments, the maturity and exaltation, and the defect and end of things.

It is observed, when the Spiritous Latex is drawn forth of any Liquor by Distillation, that the vapor or steam is not elevated into dew, that is, comes together in little drops or dew, every where poured forth, as it is wont to do in watery things; but

it is divided into streaks, and many little rivulets, and renders the Alembic mark'd in every part, with straight lines, only not meridional, leading from the Centre of the top, to the brim of the Circumference. The cause of which seems to be this, to wit, since that the spirituous substance is very subtil, it is not easily Collected into Liquor; neither is it fixed every where about the sides of the Vessel, in its ascent, as watery Liquors; but always stretches further, and unless when it comes to the top it self of the little head, doth in no wise stay; but there the spirituous breath, being restrained as it were in a punct, and being brought backward, it begins to gather into dew: wherefore, from that top, as it were the Fountain, the Spirits flowing forth on every side by streams, descend in streaks towards the mouth or brim of the Alembic. And when those lines wholly disappear, it is a sign, that the spirituous substance is quite still'd forth, and that the watery breath only ascends.

2, Sulphur is a Principle of a little thicker consistency than Spirit, after that, the most active: for when the Spirits first break forth from the loosned substance of the mixture, presently the Sulphureous Particles endeavour to follow. The Temperament of every thing, as to Heat, Consistency, and amiable frame or contexture, depends chiefly on Sulphur; from hence also for the most part arise, variety of Colours and Odors, the fairness and deformity of the Body, also the diversity of tastes. In the Bosom of this the Spirits immediately, in which as in a Copula, they are united, by the more hard embraces of the rest. The substance of Sulphur, though less subtil, is yet of more fierceness and unruliness than the Spirits are, for this unless it be restrained, by the embrace of the others, as it were in bonds, and its Particles be detained one from another by the interjection or coming between of the rest, not only leaves the subject, but destroys it self, with too impetuous an eruption. Indeed the little bodies of this being gently moved, do cause digestion, and maturation, sweetness, and many perfective qualities in things: being a little more strongly moved, they induce heat, and an excess of qualities, inordinations, and chiefly a stinking savour: but being more impetuously moved or stirred up, they bring in the dissolution of Bodies, yea a flame and Burning.

The substance of Sulphur is never seen sincere, yea it consists not of it self from others, but vanishes away into Air: its Particles being concreted and chained together, with Salt and Earth, are fixed as it were immoveable, as is seen in Metals and some Stones: or being Diluted with Spirit and Water, and temper'd together with the rest, exist in motion, by which means (as was before said of Spirit) they are in a threefold state, within the substance of the mixture: for either first of all its little bodies being involved with Salt and Earth, or too much drenched with a watery humidity, are obscured, so that they exercise but little of virtue, from whence the humid and cold temper of things exists, their qualities are Obtuse, Dull, and of small virtue or force, and the Bodies less apt to be inflamed, as is discerned in unripe Fruit, raw Juices and green Wood. Or secondly, The Particles of Sulphur begin to shine forth with Spirit, to be more thickly heaped or rolled together, and to appear eminent above the rest of the Principles. And so by its motion, they evaporate the superfluous moisture, digest Crudities, and induce a warm temper in things, active qualities, a lively force and maturation, or ripeness: which kind of exaltation of Sulphur may be observed in Wine and Liquors long Fermented, in ripe Fruits, in the Youth and florid Constitution of living Creatures. Or thirdly, The Sulphureous Particles being gathered into vigor, grow too hot, loose the bonds of mixture, and desire to fly away; and from their diverse manner of departure and separation, the dissolution of Bodies variously happens: For either they evaporate with Water and Spirit, by degrees, and without tumult, and leave their subjects lean and dry, which, when the Sulphur is wholly gon, fall into Ashes: Or secondly, in Bodies which abound with Sulphur, when the mixture is loosned, and the Spirits begin to fly away, the remaining Particles of Sulphur are wont to be very much moved, and to grow exceeding hot; and being shut up in a thick substance, are gathered together more nearly, (as in Dung and Hay growing hot) and conceive heat, and sometimes Burning: breaking forth after this manner, by heaps, and impetuously, they breath out a stinking smell, and bring on a rottenness to the subject. There is a third manner of eruption, whereby the Sulphureous Particles go forth of Bodies, when they withdraw themselves, as it were with violence, and being gathered together, break forth into fire and flame: whereby indeed becoming unbridled and untamed, they break all bars or lets, and wholly destroy the substance or frame of the Subject: By this means, by their own and proper

proper effervescency they procure a Burning, as when they being layed up wet, or the wheels of Carts, or Axeltree, made hot by motion doe fire, or because Sulphur is inkindled by Sulphur: for its Particles being impetuously moved, shake or move all that's near them, and carry them into the like motion of Conflagration, as shall be more fully shown hereafter, when we shall discourse concerning the nature of fire.

3. Salt is of a little more fixed nature, than either Spirit or Sulphur, nor so apt to fly away; but bestows a Compaction and Solidity on things, and also weight and duration. It retards the dissolution of Bodies, and promotes Congelations and Coagulations, and very much resists Putrefaction, Corruption, and Inflammation; to wit, forasmuch as it fixes the too volatile Sulphur and Spirit, and detains them in a Body: wherefore ponderous Woods, Stones, Metals, and what abound in Salt, are hardly enkindled, and remain a long while free from Corruption. Not only the duration of the individual, but also the propagation of the Species, depends very much upon the Principle of Salt, because the fertility of the Earth, the growth of Plants, and especially the frequent fructification, and bringing forth of young, in living Creatures, takes their Original from the Salty Seed: hence it is, that *Venus* is said to arise from the Sea, and Lust is called Salacity. For Salt having obtained a flux, gathers together, and stirs up into motion, the idle, or too much disjoyned little Bodies of Spirit or Sulphur, and excellently keeps them together with itself, for the producing the first ground-work of things.

Salt within the frame of the mixture, is either altogether fixed, when its Particles being almost destitute of Spirit and Water, but bound together with Earth, or Sulphur, or both of them, grow into Stones, Metals, or Minerals of another kind; which fixity in Nature is imitated in making Glasse, and Earthen Ware: or Salt is loosened from its fixedness, to wit, when its Particles being mixed with the other Principles, and chiefly with Spirit and Sulphur, and Diluted with Water do unfold themselves, and being diffused through the mixture, do Ferment with the rest: whilst the little Bodies of the Salt are after this manner put into motion, there is observed of them a threefold State or Condition, to wit, of Fusion, Volatilisation, and Fluxation.

I call the State of Fusion, when the little Bodies of the Salt being Commixed with the rest, begin as to their smallest parts to be dissolved, and diffused, and explicated here and there, through the whole substance of the mixture, as may be observed in the Germination of Plants, in the first Conceptions of living Creatures, and in the beginnings of Fermentations; hence Spring only a rude and indigested formation of things, an ingrateful savour, and for the most part bitter or biting.

From these first Rudiments of Motions, the Saline Particles ascend by little and little, to Vigor and Volatilisation, together with Spirit and Sulphur: to wit, whereby they run through the whole substance of the Body, and variously move its matter, and dispose it towards maturity. Some little Bodies sharpen, and stir up into Motion, others Fix, Establish, and Congeal into a stony hardness. If there be plenty of Spirits and Sulphur, the Particles of Salt, as their handmaids, go about to unite, and associate themselves intimately with them, that they are not only snatched together with them, through all the recesses of the mixture, but (the subject being exposed to Distillation) Salt also ascends in the Alembic, even as the Spirit. From the Volatilisation of Salt, Beauty, and Fairness, and savour chiefly sweet, happen in things, as in the florid blood of living Creatures, in ripe Fruits, as also in Sugar, Milk, and Honey, we know by experience.

I mean the Fluxation of Salt, when the saline Particles, which being first gathered together, with Earth, or Sulphur, or associated with Spirit, and so remain separated one from another, afterwards the bond of the mixtion being loosened, they become wholly free, and unloosened from the yoke of the rest: for so they flow together, explicate themselves through the whole frame of the subject, and whilst Spirit and Sulphur for the most part fly away, these exercise a dominion over the remainder, and induce a sourness into the whole mixture: by reason of this Fluxation of Salt, Wine, Milk, Blood, and Eatable Things, at first grateful and sweet, grow ingratefully soure when they begin to Corrupt; and for this Reason, all Salts whatsoever, having gotten a Flux, by a violent Distillation by Fire (that is, being driven from the Combination of Earth) grow sour, than if the same sour Liquor, be put upon the insipid dead Head, the Whole lastly becomes salted.

Salt being deprived of the Company of the rest, (except the Earth) becomes at last fixed, as is observed in Sea-Salt, or the incineration made of Herbs, whose Particles so cleave together, that they cannot be pulled asunder by the strongest Fire. When Vegetables are Distilled, some Saline Particles, though but few, made fit for Fusion, ascend with the rest; and from thence some Distilled Waters retain a genuine flavour of the mixture: The parts of living Creatures being exposed to Distillation, yield a Volatile Salt: when Minerals, or ponderous Woods full of Salt, are brought under by Chymistry, the Distilled Liquor is like to Salt that hath gotten a Flux, and is very four.

Spirit and Sulphur easily unlock the substance of the mixture, and make way for themselves; but Salt cannot, unless it be snatched forth of doors together with the Spirit it self. As Spirit and Sulphur being outwardly applyed, in dissolving or burning a Body, open as it were the doors for their Companions shut within, so also, Salt Liquors Distilled, do the same thing. For Stygian Waters strongly Corrode Metals, and are seen like a flame put to them, to burn and consume the same.

Salt resists Inflammation, for that it detains the Sulphureous Particles in its Bosom, and hinders them from breaking forth. But excepting that Sal Nitre encreases the burning of Sulphur, which indeed happens by accident, because that Salt, as it were an Hermaphrodite, grows very turgid with Sulphureous Particles also, combined in the mixture; wherefore, when the Salt is melted by other fired Sulphur, the shut up Sulphur, breaks forth with violence, and (like a blast from a Bellows) shakes the in-kindled fire round about, and drives more impetuously the subject into a Body: In the mean time, if you put the flame to Nitre, it will not be inkindled at all; but being put to a Sulphureous Body, it promotes its enkindling; but the other Salts, less turgid with Sulphureous Particles, or rather destitute of them, being mixed with Sulphur, hinder its inkindling, and sometimes put it out.

So much for the Active Principles, which effect, as it were, the first ground-work of Bodies: those which follow, chiefly bestow on them Consistency and Substance. For from hence exist either Liquids or Solids, Small things or Great. For Water and Earth, fill the little spaces that are empty, through the Combination of the rest, with their coming between, and amplify and enlarge the lineaments of the Body, otherwise too short and contracted.

4. Water is the chiefest Vehicle of Spirit and Sulphur, by whose intervention they consociate one with another, and with Salt; for the other Principles, being dissolved by a watery humor, or at least diluted, continue in motion, without which they grow stiff, as congealed things.

When Water is wanting, the active Principles meet together too strictly, and mutually rub against, and consume themselves; and when for this reason, the suppliment of food is cut off, the Body grows withered. If humidity abounds too much, these Elements are estranged or dissociated too much one from the other, wherefore the subject becomes sluggish and slow, and of less efficacy, and unapt for motion. Besides, Bodies too moist, are lyable very much to rottenness and Corruption; because from too much Humidity the Combination of Spirit, and Sulphur, and Salt, is too loosely effected; that they do not mutually embrace one another, nor are retained with their embracement, in the subject. Indeed Water abounding easily evaporates, and then the frame of the mixture being loosened, and the doors set open, Spirit and Sulphur easily break forth, the way being made, and leave the subject, as it were vapid, or made sharp with Salt: for from hence, the infusions of Vegetables, Decoctions, Juices of Herbs, and all Liquid preparations, if the quantity of Water be greater than the rest of the Principles, and impropportionate, quickly Corrupt.

Water is most easily drawn forth out of every thing by Distillation, for when Spirit and Sulphur are often intangled with nets of Salt or Earth, they hardly let go their embraces, and are not obedient but to a more intense heat, and often times require a previous Putrefaction. Water most easily, and often with no labour, is driven out of every Body. But most often it snatches in its flying away, some more loose Particles of Spirit and Sulphur, and carries them with itself, forth of doors.

5. As the interjection of Water in Liquids, so of Earth in Solids, fills the empty little Spaces and Vacuities, left by the other Principles. For these, hinder the active Principles from a too streight embrace, whereby they should rub against themselves, and cleave one to another; also by its thickness, it retains

too Volatile things: besides, it enlarges the due substance, and magnitude in Bodies.

The more that Earth abounds in any thing, it is so much the less active, but of longer duration: hence Minerals endure a long while, then next the greater Trees; in the mean time Animals, and the more slender Plants, are but of short age.

In Distillations, Earth ascends the Alembic, almost not at all, or but in a very little quantity: for the most part it is left, with a portion of Salt, for a *Caput Mortuum* or Dead Head; therefore it is called *Terra Damnata*, or damned Earth: because, when the other Principles are freed, the Prison being as it were broken, this is still detained: besides, Earth being deprived of the Company of the rest, is of no Use, nor capable of change, or exaltation.

Thus much for the Elements or Principles of Natural things, considered apart, and by themselves. It follows, that some of their Affinities and Conjugations be unfolded: because these very strictly cohere with those, and very hardly or not at all are joyned with others. Out of the mutual Combination of some, and disagreement of others, various Affections arise, the knowledg of which gives no little Light to the Doctrine of Fermentation.

There is a certain Kindred and Similitude of parts, between Spirit and Sulphur, which are agil or light, and easily to be dissipated in both; wherefore, Spirit being driven forth of the Body, draws abundantly with it Sulphureous Particles, as is discerned in Spirituous Liquors Distilled out of any thing; to some of which if you mingle Water, the Liquor appears as it were troubled with precipitated Sulphur; but the Spirit without the Sulphur is undiscernably mixed with the Water, which however by reason of its Volatility, may be also easily drawn away and separated by Distillation.

Altho Spirit and Sulphur are Principles very resembling, and (because of a ready motion) either are inflameable, yet they are not one and the same, as is asserted by some: For Sulphur Copiously subsists in Bodies almost destitute of Spirit, to wit, in common Sulphur, Antimony, and other Minerals; in which its Particles are very fixed, and of their own nature almost immoveable, which is very far from the Nature of Spirits: For they abounding in any mixture, never lye idle, and always in motion, bring various alterations to the Subject where they dwell; then if they abound in strength, they easily and without tumult carry themselves forth of doors of their own accord. But Sulphur, altho it abound, doth not easily evaporate, but hath need of a strong heat, or an actual fire, that may make a way for it; and lastly, it breaks forth, not without a stink or burning: yea, if you endeavour to Distil Oyl and Fat things, although very Sulphureous, with a moderate Fire, they are wont to yield a Liquor only Waterish, and not inflameable; but if we provoke generous Wine, which swells with Spirit, by the gentle heat of a Bath, a most burning Water will Still forth, and apt wholly to be inflamed.

Spirit is not presently joyned with Salt: For Sugar and Salts are scarcely dissolved, by the rectified Spirit of Wine, but are after a manner associated by a long digestion and circulation; as is perceived in the Volatile Salt of Animals, or Tincture drawn forth from the Salts of Herbs, or of Minerals, by the Spirit of Wine. If that Spirits excel in plenty, and virtue, they assume to themselves, and Volatilise the Saline Particles. And therefore the Salt contained in the Juice or Blood of Animals, being associated with Spirit is volatilised: also the Spirit of Wine, being Distilled by many Cohalations, with the fixed Salt of Herbs, renders it Volatile, and makes it pass through the Alembic; but if the power of the Salt be greater, it tames the Spirit and fixes it. Hence the blood, being become Salt, by means of an ill dyet, becomes less Spirituous. Fixed Salts, and the Oyl of Vitriol fix the Spirits, grown too volatile, and unbridled; and Coagulate the Spirit of Wine it self.

But Sulphur is a more fit subject of the Spirit, by the coming between of which it easily is united with Salt and the other Principles; and as Spirit best agrees with Sulphur and Water, so Sulphur intimately cleaves to Earth and Salt.

As to Sulphur, besides its affinity with Spirit, it hath a great relation with Salt it self, to the volatilisation of which it doth not a little help: wherefore in Bodies which abound with a volatile Salt, there is found plenty of Sulphur, as in Amber, Soot, Hornes and Bones, as also in the excrements of living Creatures; where Salt and Sulphur are in motion, and evaporate from the subject, a very stinking smell is sent forth;

forth; for Sulphur being sharpned with Salt, pricks more strongly the sensory, and strikes it with its sharpness; in the mean time, Sulphur exhaling with Spirit, both pleases the sense, and excites a very pleasant Smell.

Sulphur is as it were distracted between Spirit and Salt, and adheres at once to both parties. In the Distillation of Amber, Turpentine, Harts-Horn, and the like, a certain lesser part of Sulphur, being united to Spirit, first ascends, and causes a Yellow Oyl, or clear Liquor of a grateful smell: the other part of Sulphur, being joyned to the Salt, is driven forth in the second place, and is Distilled with a most stinking smell, in the form of a red or black Oyl: In like manner, in the Circulation of the blood, a pure and delicate portion of Sulphur, being mixed with the Spirit, supplies both the Animal and Vital Spirit with matter; the other more thick part, being Boyled and Roasted with Salt, is layd up in the Chole-dock Vessels (or belonging to Choler) as it were a certain excrement separated from the blood. As Spirit does not easily Cohere with Salt, so Sulphur does not with Water: wherefore Fat and Oily things, as also Gumms and Sulphureous Refines, either swim upon the Water, or sink down to its bottom. But Sulphureous things, Salt coming between, are commixed with a Watery Liquor, as we see Oyls imbued with Sugar or Salt, to be dissolved in common Water, which otherwise would flow separate.

Sulphur is not so tractable in Distillation, as Spirit, Water, or Salt: for the Particles of this, being very Viscous, stick together among themselves, and also to others, that they cannot easily be pulled from their embrace. Hence among Sulphureous things, there are some, which are not forced, but by a strong and burning heat, into a stinking Oyl, and very empyreumatick, or smelling of Fire: but others, more pertinaciously cleaving together, are not to be loosened by Distillation, but are only broken into integral parts; and so ascend under the form of a dry Breath, as common Sulphur, Benzoin, Camphor, and the like.

Salt, besides its affinity with Sulphur, is also most strictly united with Earth; wherefore Stones, and the more hard Minerals, consist chiefly of Salt and Earth. The Acid Spirits of Minerals, (which are only Salts resolved into Liquor by Distillation) if at last they be poured on the *Caput Mortuum*, Cohere with a strict embrace to it, that there will be need of a most strong Fire, to drive them forth again. Also in Glass, the union of Salt and Earth is so strictly made, that it will not suffer a Divorce by any means. Salt also is most easily dissolved in Water; and it melts of its own accord, in a moist Air: and these are as easily separated one from another.

By reason of these Combinations, these Principles have got various Appellations, and not Congruous in their own Nature to themselves. For Sulphur, for as much as it is Associated with Spirit, is called pure and sweet; when with Salt, impure and stinking, for as much as with Salt and Earth, it is called thick and Earthly; when the Spirit assumes to it self Sulphureous Particles in a moderate quantity, it is seen to be sweet; when saline, sharp; when both, bitter. Salt has a diverse disposition, and is known by many names, by reason of its various mixture with the other Elements, and chiefly with Earth: for besides the Titles of Fluid, Fixed, Volatile, for this reason it is termed Marine, Aluminous, Nitrous, Vitriolick, Armoniack, or of some other kind. By some, these kind of Conjugations are esteemed, but wrongfully, as so many divers Principles, when they are but more simple mixtures, by the coming together of the first Elements, and being loosened by Distillation they openly shew their Race, from whence they are. For all Salts whatsoever being driven into a Flux by the Fire, shew Liquors very near of Kin one to another, to wit, Acetous: by the like means Spirit and Sulphur are compelled to put off their Masks, and to resume the Native Species common to each.

And so much for the Principles of Natural Things, and of their Affections and Conjunctions. It is abundantly manifest, that these kind of Substances are in every Body, (besides the Analyses of Bodies Chymically instituted) also from the Mutations, and effects of Things, which happen of their own Nature. When Must is Ripened into Wine, is not Spirit, a Sulphureous part, also Salt, and Earth Conspicuous to our Taste and Eyes, besides the watery Liquor? Also the Juice of every Plant being exalted by Digestion, exhibits the same sincere, and as it were distinct: what is greater, things subject to the Flame, when they seem to be burnt, and reduced almost to nothing, they go into these kind of Particles; besides the Salt remaining in the Ashes, the Smoke and Flame grow together into Soot, as if were a Meteor, in which are

are comprehended together, Spirit, Sulphur, Salt, Water, and Earth, as it were in a certain compendium of the mixture. For the active Principles abound in Soot, more than in any other inanimate Body.

But because with some there hath spread a certain suspicion, that those our Principles, chiefly the Saline and Sulphureous, are to be produced for the most part by Fire, and are no ways to be found in mixt things, unless after the coming between of that: I will witness to you in some instances, that the thing is plainly otherwise. Concerning the first, It is commonly known, that the Ashes of every Plant, being once Elixivated, or made into a Lye, if it be afterwards Calcined, will not yield any thing of Salt; besides if Concretes being Distilled, Exhale or Breath forth a very sharp or acid Liquor, their Calx is not saltish; and on the contrary when the Salt being Volatilized or brought to a Flux, ascends the Alembic, you shall seek for it in vain in the dead head. To prove the existency of the Sulphureous Principle in Vegetables, take Guaiacum, or a piece of any other ponderous Wood, and being put into a Glass Retort, draw it forth by degrees; it shall exhibit, together with an Acid Liquor (which water is saltish) in great quantity, a blackish Oyl (which part of it is Sulphureous.) It appears from hence that this was in the Body before the Distilling, and in no wise produced by its Operation, because if you proceed after another manner, that the Sulphur may be taken out of the Concrete before Distillation, the Liquor that comes forth will be almost wholly deprived of its Oyliness: Wherefore, if you pour Spirit of Wine to those Chips of Wood, it will Extract in a great quantity, by this Menstruum, a pure Refine, which is the Sulphureous part it self: then if you Distil (as before) in a Retort, the remaining Chips being washed in common Water and dried, you will have a very little Oyl only. What is more to be admired, and confirms also more fully the truth of this kind of Origination, some Bodies, which being almost destitute of Spirit and Sulphur (because chiefly Volatile) consist chiefly of Salt, Earth and Water, are separated into these Elements by Distillation: the same mixture in number, and wholly known by the same accidents, is restored to them, being mingled together again; for example, if you Distil Vitriol in a Reverberating Furnace, you shall have a Phlegm almost insipid, or a Watery part, then a Liquor very sour, or a Salt having gotten a Flux, and in the bottom, a Red Earth, and finely Purpled: this being rightly performed, if the two Distilled Liquors be poured to the dead head, you shall have the same Vitriol, as you had before, and again revived, in the same Colour, tast, yea and almost in weight. In like manner you may proceed, with the same success, with Nitre, Sea-Salt, Salt of Tartar, and perhaps with Alum and other Minerals: So that those Concretes, which consist of fixed, and stable Elements, may like a Mechanick Engine be pulled into pieces, and presently without hurting the Machine, be restored or made whole. But there is enough spoken concerning the Principles of Natural Bodies. These being thus premised, we will proceed to the thing proposed in the beginning, to wit, the Doctrine of Fermentation.

CHAP. III.

What Fermentation is: Its Division as to the Subjects, and first of Minerals.

Fermentation is an intestine motion of Particles, or the principles of every Body, either tending to the perfection of the same Body, or because of its change into another. For the Elementary Particles being stirred up into motion, either of their own accord or Nature, or occasionally, do wonderful more themselves, and are moved; do lay hold of and obvolve one another: the subtil and more active, unfold themselves on every side, and endeavour to fly away; which notwithstanding being intangled, by others more thick, are detained in their flying
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away. Again, the more thick themselves, are very much brought under, by the endeavour and Expansion of the more Subtil, and are attenuated, until each of them being brought to their height and exaltations, they either frame the due perfection in the subject, or compleat the alterations and mutations designed by Nature.

Fermentation is an action or motion meerly Natural, and what doth perform it, are only Particles Naturally implanted in the Concrete; yet as to the subjects in which they are found, it is wont to be variously distinguished. And either things of Nature are said to Ferment in a threefold Family, of Minerals, Vegetables and Animals; or the Works of Art, to wit, when Actives are applied to Passives by an outward Agent. Though the Term and consideration of Fermentation, are chiefly due to Artificial things, and things made by Hand; yet it will not be from the purpose, to speak first somthing of Natural Things, that a Comparifon being made of either, the Truth of our Hypothesis, and the certainty of the Principles may be confirmed. But this only lightly and by the way, in this place I shall pass over, because their more full handling belongs to Physiologie, or the Discourse of Natural or Physical Things.

In the first place, as to Minerals, altho in the Bowels of the Earth, the Fermentation is less conspicuous than in the Superficies, yet it easily appears that the Elementary Particles, or the Fermentative Principles, are included in the depth of the Earth, as in a certain pregnant Womb: which there constitute Concretes, and things gathered together, by strict Embraces, the Productions of Minerals; but being loosned, and moved in the Bosom of the Earth, or exhaled upwards, cause the appearances of Meteors.

First, The Generation of the more hard Minerals, induces rather Congelation than Fermentation; because indeed these Principles, growing together in every Subject, are so fixed, and as it were bound together in Bonds, that they are not able any ways to move themselves, or to depart one from another. This kind of Fixation chiefly depends on the plenty and greater proportion of Salt and Earth, (sometimes with an addition of Sulphur) than there is of Spirit or Water. To wit, Salt and Earth, being most small broken, and resolved even into a Vapour, lay hold of one another, and stiffen into a hard matter, and at last not to be loosned; almost after the same manner as making of Glafs, and the burning of Bricks and Earthen Ware, are performed. For Glafs consists of Salt and Earth, which when being broken into most small bits by a very intense Fire, they suffer a Flux, they mutually lay hold of one another, and so strictly and intimately come together, that they are never to be parted. Glafs is more fragil, or easie to be broken, than Earthen Pots, or Minerals, because it has a greater plenty of Salt, than of Earth, which is more plentiful in Earthen Ware, and in Minerals: To some of which, also happens a modicum of Sulphur, and for that reason they are more tenacious and ductil; as is to be observed in Metals, when in the mean time stones, and what contain little of Sulphur, are fragil, and apt by every stroke, to fly to pieces. In Vitrification there is need of a violent Fire, for the fusion of the Salt and the Earth, (whose Particles, as is commonly said, are the Pestles of the Chymists) but within the Bowels of the Earth, there is not required such a fusion by Fire, for the Concretion of Minerals, because Salt and Sulphur exist, being naturally resolved into most simple Particles; which, when they lay hold on the Earth, easily stiffen into Metal, or into a stony hardness. There are some Fountains found out, which, for that they flow with a Primitive Salt, and resolved into small Particles, whatever Bodies are immersed therein, they cause them presently to become stony. We have read also, of Men changed into Stones, yea a whole City to have been stiffned into a stony substance, by the Air, or by some Vapour brought forth of the Earth: The Faith of which thing is left to the Authors.

Meteors are made out of the same Principles by which Minerals are made, and conceived almost in the same Womb: but loosned from Concretion wandring here and there, and diversly fluctuating: or which being included in Subterraneous Vaults, and there moved, produce divers Springings up of Fountains, or ebullitions of hot Vapours; or exhaling from the Dens of the Earth, and being mixed with Airy little Bodies, they cause within the Region of the Atmo-Sphear, as it were a diverse fashioned Landskip, of Clouds, Winds; and the appearances of other things, in the Superficies of the Earth, or on high: in either there are highly active Principles, chiefly Salt and Sulphur. Spirits are either deficient in Meteors, even as in Minerals, or are found only in a very small quantity or proportion: to wit, they are almost wholly excluded from these, by reason of the strict frame of the Subject, which doth

doth not easily yield space, and passage for their motion; also they abstain from those (*viz.* Meteors) by reason of the lax, and wholly loose structure of Matter, from whence they, who are mighty in swiftness, easily break forth, and desire to fly away.

Within the Bosome of the Earth, the Saline Particles being loosned, even into a Vapour, and then kneaded with an Earthy Matter or the moistning of Waters, they cause Eruptions of Fountains, and Acidulous or Spaw Waters, which resemble the disposition of Vitriol, Alum, Nitre, sometimes of Iron or Copper. Also the Sulphureous little Bodies being loosned, and gathered together, inkindle an Heat, and sometimes Subterraneous Fires; by whose Breaths the Dens and Caverns being made Hot, like an Hot-House, whilst the Watery humors pass through them, they from thence conceive their Heat, and supply the Springs of Hot Fountains for Bathes.

In like manner, in this visible and Etherial world, Vapours both Sulphureous and Saline, and of a diverse Kind and Nature, perpetually breath forth, and are diffused through the whole Region of Air. From hence the diversity of winds, the vicissitudes of Cold and Heat, Rain, Snow, Hail, Dew, and Hoar Frost, and what are of this Nature, have their Origine. Concerning the particular instances of these, the famous *Gassendus* may be consulted, who in his *Epicurean* Philosophy, most aptly deduces the Phænomena, almost of all Meteors, and the reasons of them, from the Exhalations of Sulphur, and Salts, either Nitrous, Vitriolick, Aluminous or Armoniack.

CHAP. IV.

Of Fermentation for as much as is observed in Vegetables.

IN Vegetables, Fermentation is yet more plainly discerned: for whilst they Bud forth, Grow, Flower, bear Fruit, Ripen, Decline and Dye, we may observe the divers motions of Particles or Principles, their various Habits and Tempers. I intend not here to describe the several ways and proceedings of these. It will be sufficient, for the unfolding the Doctrine of Fermentation, to take notice of some chief instances, concerning this Subject.

If is manifest, by dayly Experience, that all Plants whatsoever, exposed to a Spagyricall or Chymical Operation, may with little labour, be resolved into the afore-said five-fold Elements: But in some there is found a greater plenty of Salt, in others of Sulphur; in some Spirits abound: Water, and Earth, are in most proportionated, according to the Bulk and magnitude of the thing. Plants in which Salt abounds, with a mean of Sulphur, and a little quantity of Spirits, are for the most part of long Age, somewhat big, or flourish all the Winter, or tho their Leaves fall, they keep a Nutricious Juice under the Bark. Of which sort are the Oak, Ash, Elm, Box-Tree, and all ponderous Woods and Shrubs.

In some Sulphur abounds, with a little Salt and Spirit, as are the Pine, the Firr-Tree, Cyprus Tree, Juniper, Ivy, Olive, Cedar, and Myrtle Trees, and all resinous Plants; which, for the most part have a sweet smell, and are perpetually Green, by reason the juice, wherewith they are nourished, is viscous, and not easily to be dissipated. In others, besides plenty of Salt, and Sulphur, Spirits also are found, in a greater proportion, as are Fruit-bearing Trees, and especially the Vine, from whose Fruit the Juice being wrung out, and purified by Fermentation, grows very big with Spirit. Of this rank are Plants for the most part Medicinal, also such as produce Curious, and Odoriferous Flowers, But in some Water and Earth luxuriat in too great a quantity above the other Elements, as in cold Plants, and such as grow in too rank a Soil.

The Germination of Plants happens after this manner, either it is made out of the Seed, Root, Trunk, or of its own Nature, from the naked matrix of the Earth. First, the Spirit being shut up within, by the Ambient Heat and Moisture loosening the frame of the mixture, being loosened, it presently endeavours to fly away: But being held back in its flight, by the more thick Particles of the rest, stretches forth more largely its Den, and together with the other Principles, with which it is bound, thrusts forth on every side, into length and breadth: even as a little bundle of Silk, being contracted into wrinkles and folds, is opened here and there: In the mean time, the little Spaces left by the enlargement of the Spirit, and as it were made hollow, are filled up by the next Matter, driven even into the Vacuities. And after this manner the Architect Spirit, with his Ministers, Salt and Sulphur, still stretching forth it self, like a Snail, frames for it self an House, whose Inhabitant it is, and by dilating it self, stretches forth that, until at last it hath wrought the Plant into the due Bulk and Figure designed by Nature.

You may take notice, that the times of the year, for the Budding, Flowring, Ripening, and decaying of Vegetables, are of great Efficacy and Virtue: All the Winter, the Womb of the Earth, as it were shut up, is almost barren: for the Spirituous Particles, which are wont to actuate the rest, and as it were to lead the dance of Natural Motions, are either chased away by the Winters Cold, or being Congealed in their Subjects, are fixed: Wherefore at this time Germination and Vegetation are very rare, unless that some irregular Plants, which are composed of plenty of Spirit, Salt, and Sulphur, dare to break forth. But in the Spring, when the bowels of the Earth begin to be a little warm, by the Vicinity of the Sun, presently they are impregnated with a wonderful Fecundity, and produce the effects of their Seminality. Not only the Superficies of the Earth, but also the Water and Air, every where, grow big with Spirituous Particles; which as it were raise up from the Dead, the little Bodies of Salt, and Sulphur, and bring them into Motion: Therefore, besides that the Plants Bud, the Juice and Blood of living Creatures is quicker and more apt to abound. At this time the Birds and Fishes build their Nests, and bring forth Eggs: also we may perceive in our selves the Blood to flow high in the Vessels, and usually to Ferment too much. For all things are then full of this Ætherial Substance, and the whole Bulk of Nature, as it were inspired by a lively Fermentation, is abundantly fruitful of Motions and Generations. Yea, these our Principles, at first separated and dispersed one from another, led as it were by an Appetite of Copulation, enter into mutual Marriages, and being Married together, almost with infinit Embraces, cause a most ample Seeding, and Germination of the Herby State.

At the beginning of the Summer, (and perhaps in some sooner in some later) when sufficient time hath been granted for the Stature and Magnitude of every Plant, and that it is now come to the highth of increase; it behoves Nature to perfect her Work, and to cook and ripen the Substance, as yet rude and undigested: Wherefore the active Principles leisurely extricate themselves from the more thick, and creep forward towards the top, there being placed with a mutual increase, they are formed into Flowers and Blossoms, from which at length (for that they are of a soft and light texture) Spirit and Sulphur easily evaporate, and the frame of the mixture quickly decays. But Nature careful of the perpetuating every thing, when it cannot keep for ever the individuum, is so provident, that the Species may not wholly perish: Wherefore she institutes new and more firm and lasting Combinations of Spirit, Salt and Sulphur. For she selects from the whole Substance of the Plant, the more noble and highly active Particles, and these being gathered together, with a little Earth and Water, she forms in the Seed, as it were the quintessences of every Plant; in the mean time the Trunk, Leaves, Stalks, and the other Members of the Plant, being almost quite deprived of the active Principles, are much depauperated, and are of less Efficacy and Virtue.

About Autumn, after the Seeds are framed, (as it were pledges left in memory of the Plant) the Particles of Spirits, Salt and Sulphur, which remain, being now placed in their Strength or Exaltation, endeavour a Dissolution, and Departing one from another. And first of all, the Spirits evaporate by degrees with the Watery humour, through the Doors set open by the Summer Sun, with which the more pure parts of the Sulphur, make also their Journey: in the mean time the Salt being fixed with the Earth, and more thick Sulphur, is left behind: Wherefore in most the Leaves fall at this time, and in those of a tender and light Constitution, the Principles are wholly

wholly dissipated, and the Trunk and Stalk, together with the Root, wholly die. In some, after the falling of the Seed, with the Leaves, the Stalks wither; in the mean time the Principles, which may renew the Plant in the next Spring, are preserved in the Root.

Also Winter coming on, the face of things is wholly changed; and the Elements, which in the Spring did affect to be Joyned and to Marry one with another, seek nothing more than Divorces. The Spirits fly away from very many things, and wander in the Air; in the mean time the Particles of Salt and Sulphur lie as it were benumbed and asleep. Not only the Bodies of Vegetables, but of very many Animals, are left as it were dead all the Winter, till they are raised again to life by the Spirit, returning with the Vernal Sun, and as it were animated anew. But this little Branch being made concerning the Vegetation of Plants, it is now fit that we proceed on our Journey to Fermentation, by the Rule of our before established Method, to what is to be observed, concerning the parts, and humours of Living Creatures.

C H A P. V.

Of things to be Observed of Fermentation about Animals.

IT is so certain that the Bodies of Animals, consist of the aforesaid Principles, that it wants no proof. For they so plentifully swell up, with Spirit, Salt and Sulphur, that their Particles are obvious to the sense: Wherefore they are moved with a more swift motion, and more excellent senses of Life, and Functions of Heat, in the Subjects, in which they are implanted, are enlarged. It would be too much labour, and tedious, here to describe, the several manners and processes of Fermentations. The first beginnings of Life proceed from the Spirit Fermenting in the Heart, as it were in a certain little punct. The motion of this, is not as in Vegetables, slow and insensible, and only to be known by their increasing; but presently becoming rapid, is conspicuous to the Eyes: because the Spirit leaping from the Punct, as from a Prison, being stirred, and having obtained the Vehicle of Blood, swiftly runs forth; and leaping forth, it cannot wholly fly away, it makes hollow spaces for it self in the thick substance, in which it is included, for its excursion, being compelled some other way backward. Lastly being returned to the Heart, it Ferments the more, wherefore it stretches forth further the spaces of its Excursion, and so easily makes an hollow way for its return back; and after this manner, for the carrying about the Blood, Arteries and Veins, as Channels and Rivulets are framed through all the parts of the Body: and on such a Vicissitude of Motion, or Reciprocation, depends the life of living Creatures, which, that Nature might preserve a long while, she placed the Ferment in the Heart, by whose instinct, or endeavour, the Blood grows impetuously Hot, and as it were inkindled into a Flame by its Deflagration, diffuses the *effluvia* of its Heat round about on every side: for by the Fermentation, or Accension which the Blood suffers in the Bosome of the Heart, very many Particles of Spirit, Salt and Sulphur, endeavour to break forth from its loosened frame: by which being much rarified, and like Water boyling over a Fire, the moved and boyling Blood is carried through the Vessels, not without great Tumult and Turgescency. We would speak more in this place, both of the Natural Fermentation of the Blood, and the Feaverish, but that we reserve this Consideration for a peculiar Tract, where we Treat of Feavers.

Besides this Ferment constituted in the Chimny of the Heart, upon which the motion and heat of the Blood very much depends, there are others laid up every where in the Bowels, of a diverse disposition, by the help of which, both the Chyle (which is the Rudiment or Beginning of the Blood) and the Animal Spirits, its Quintessence, are truly framed. There are others also which serve for the perfecting the Blood, transmuting it into other Liquors, and freeing it from Excrementitious Matter: It will
be

be too far from our proposed method, to wander, to insist upon each of these, and to reap anothers Harvest: Wherefore I will only add in this place, some select instances, which may illustrate the Doctrine of Fermentation.

It is commonly received, that the Concoction of the Chyle, in the Ventricle, is made by the means of a certain Acid Ferment: That such a thing is the Acid belching in a full Stomach, and the want of it in the loss of Stomach, in Feaverish and Dysenterical people do testifie, &c. and its restitution a sign of Health: to which may be added this Observation; Chalybeat Medicines being taken at the Mouth, a little after excite a Sulfureous savour in the Throat, as if hard roasted Eggs had been eaten: which seems wholly to be made by the Acid Ferment of the Ventricle, gnawing the Iron, even as Spirit of Vitriol, being sprinkled upon the filings of Steel, excites such a stinking and Sulphureous Odor. Some say this Ferment is breathed into the Stomach from the Spleen, but by what means that may be done doth not yet appear by Anatomical Observation. It seems not improbable that this Ferment is implanted in the Ventricle, that it is only made by some remains of the perfected Chyle, which fixed in the folds of the Ventricle. and there growing sour, puts on the Nature of Ferment; even as a portion of Dough being fermented or leavened, and and kept to a sourness, becomes a convenient Ferment or Leven, for the making of Bread. In like manner this kind of Acid humour being prepared from the Aliments, and long carried in the Ventricle, promotes the Concoction, and subaction or subduing of the Food. For Acid things, which are full of Salt, carried out to a Flux, excellently conduce both to the Fermenting and Dissolving of Bodies: Wherefore by the action of this, Salt and Sulphur, with which eatable things very much abound, are broken in the Ventricle, and are reduced into very small parts. The Chyle being after this manner Fermented, acquires a Milky colour, by reason that the Sulphureous Particles are dissolved together with the Saline, and mixed with the Acid Ferment. For if you pour an Acetous humour to any Liquor impregnated with Sulphur and volatile Salt, it presently grows white like Milk; as may be discerned in the preparing the Milk of Sulphur, or the Resinous extracts of Vegetables. Yea, the Spirits of Harts Horn, or Soot, being very full of Volatile Salt, if they be poured to any Acid Liquor, or simple Water, acquire a Milky colour.

Concerning this Ferment hid in the folds of the Ventricle, it is observed that it is after various manners, and changes the Aliments by a diverse means: for tho in a sound Constitution it is indifferently Acid, and chiefly owes its force and energie to the Salt being brought to a Flux; yet it often declines from this laudable condition, and contains in it self either too much of sourness, or less than it ought to have: In the former Case, where the Salt hath got too sour a Dominion, all things taken in, (the Saline Particles being carried forth to a Flux, and the rest unduly brought under) presently grow sour: as most often happens in Hypochondriack Distempers: on the other side, where the Volatile Principles obtain the first place, (Fermentation being too hastily made) the Sulphureous parts of the Chyle are suddenly, and as it were forcibly exalted; and the unconcocted of the Saline, pass into Choler: which ordinarily happens to those abounding with bitter Choler. They therefore who have the Ventricle affected after this latter manner, Sweet and Fat meats being eaten, they are troubled with a bitter and bilious Taste: Again, they who suffer the contrary disposition, altho they eat the most simple Food, send forth plentifully Acid and Stinking belchings: and indeed this seems to come to pass even after the same manner, as when a little too much Yest is put to the Batch of Dough, it becomes bitter; or when too great a Portion of sour Ferment, or Leven is put to the same Dough, the Bread from thence contracts a mighty sourness.

As the Blood in the Heart, and appending Vessels, the Chyle in the Ventricle, so the Animal Spirit is wrought in the Brain, whose Original and Motions are very much in the dark. Neither doth it plainly appear, as to the Animal Spirit, by what workman it is prepared, nor by what Channels it is carried, at a distance, quicker than the twinkling of an Eye. But it seems to me that the Brain with Scull over it, and the appending Nerves, represent the little Head or Glassie Alembic, with a Spunge laid upon it, as we use to do for the highly rectifying of the Spirit of Wine: for truly the Blood when Rarified by Heat, is carried from the Chimny of the Heart, to the Head, even as the Spirit of Wine boyling in the Cucurbit, and being resolved into Vapour, is elevated into the Alembick; where the Spunge covering all the opening of the Hole, only transmits or suffers to pass through the more penetrating and very subtil Spirits,

Spirits, and carries them to the snout of the Alembick : in the mean time, the more thick Particles, are stayed, and hindred from passing. Not unlike this manner, the blood being delated into the Head, its spirituous, volatil, and subtil Particles, being restrained within by the Skull, and its *meninges*, as by an Alembick, are drunk up by the spongy substance of the Brain, and there being made more noble or excellent, are derived into the Nerves, as so many snouts hanging to it. In the mean time the more crass or thick Particles of the blood, being hindred from entring, are carried back by Circulation : But the highly agil and subtil Spirits enter the smallest and scarcely at all open pores of the Brain and Nerves, and run through them with a wonderful swiftness : For there is need only of such Receptracles and Channels, for the Animal Spirit, in which there are none, or at least very small cavities or holes; otherwise the blood or excrementitious humours, their Followers and Companions would not be excluded. Also, besides, if these Spirits should run about through too open and loose spaces, being easily dissipated, they would fly away : wherefore, when there is need of a Pipe for the transmitting of blood, or serous water, the Spirit of Wine runs rapidly through the secret passages of the Instrument or Leather. Neither doth the more strict frame of the Brain and Nerves serve only for the straining of the subtil from the thick, and the pure from the impure ; but also that spirituous and most subtil Liquor, being as it were distilled from the blood, gets yet a farther perfection in the Brain ; for there being inspired by a certain Ferment, whereby it is yet more volatilised, it is made more fit for the performing the offices of motion and sense. Because the substance of the Brain is exceeding full of a Volatile Salt, which is of great Virtue for the sharpening and subtilising the Spirits ; therefore the Spirits of Harts Horn, or of Soot, are far more penetrating than Spirits of Wine.

The Seminal Vessels and Genital Parts, do so swell up with Fermentative Particles, that there is nothing more : here Spirit, Salt, and Sulphur, being together compacted, and highly exalted, seem in the Seed to be reduced as it were into a most noble Elixir. These kind of active Principles do not only Ferment in the Womb, for the forming of the Child or Young ones, but also as it were with a living Ferment, they inspire through all the Body, the whole Mass of blood, that it may be more Volatile, and more sharply Hot : wherefore in women who have the Ferment of the Womb in good order, their Face is furnished with a curious and flourishing colour, their heat is more lively and copious ; moreover, the Mass of Blood growing too rank, there is need of emptying it every Month by the Flux of their Courses ; but when this Fermentation from the Womb is wanting, both Virgins and Women become Pale, and as it were without blood, short winded, and unfit for any motion. Also in men, from the Seminal Ferment, happen abundance of heat, great strength, a sounding Voice, and a manly eruption of Beard and Hair ; by reason of the defect of this, men grow womanish, to wit, a small Voice, weak Heat, and want of Beard are caused.

Since we Treat of Ferments, which are found in the Animal Body, we may here opportunely inquire, what is the use of the Spleen : concerning which all good things are said by some ; that it is as it were another Liver, and serves for the making of blood, for the *Viscera* of the lower Belly : It is by others reputed to be of a most vile use ; that it is only the Sink or Jakes, into which the Feculencies of the blood are cast. By reason of its structure, we make this sort of conjecture ; because the Arteries, do carry the blood to this, and the Veins bring it away, neither any other thing is carried in, or conveyed out, and for that its substance is filled with black, and stagnating blood, it seems that it is as it were a store-house for the receiving of the earthy and muddy part of the blood : which afterwards, being exalted into the Nature of a Ferment, is carried back to the blood for the heating of it : Wherefore, while the blood being carried by the Arteries enters the Spleen, something is drawn from it, to wit, the muddy and terrestrial Particles, which are as it were the dregs, and *Caput Mortuum* of the blood ; that by this means the whole Mass of the Blood, might be freed from the Melancholick or Atrabilous Juice ; which is separated in the Spleen, even as the yellow Bile or Choller, is in the Liver : wherefore, for the most part the Spleen is of a black or blewish colour, by reason of the Feculencies or dregs there lay'd up. But as this Juice deposited in the Milt or Spleen, is not altogether unprofitable, but by reason of the plenty of fixed Salt, is of a very Fermenting Nature ; it is not presently, as the Choler, cast into the sink, but is farther Cooked in the Spleen, and being exalted goes into a Ferment ; which being lastly committed to the blood

blood, promotes its motion and Volatilisation: Wherefore, as something is drawn from the blood, entring the Spleen by the Arteries, to wit, the Crude Juice of Melancholy; so something is continually added to the same, flowing back through the Veins, to wit, the same Juice concocted and exalted into the Nature of a Ferment: Even as Chymists, in Distilling, that the Liquor may be made better, separate the Subtile and Spirituous parts, from the *Caput Mortuum*, and then pour them on it again; and this work they so often repeat, till the *Caput Mortuum* or dead Head, is by frequent Distillation Volatized, and the Liquor rightly exalted, even in all its Particles. That this is the use of the Spleen, it is a sign, for that this inward being ill affected, the blood either ferments too much, as in the Scorbutick and Hypochondriack Distempers; or if the Spleen be obstructed, or beset with a Scirrhus Tumor, the blood is destitute of fit Fermentation, and causes the Dropsie, Cachexie or evil disposition of the Body, or the Tympany.

As we assert, the Earth and muddy part of the blood, which consists chiefly of Earth and fixed Salt, being separated in the Spleen, to pass there into a Ferment; so it seems not improbable, that also the Aduft, or as it were the fiery part of the blood, to wit, the Yellow Bile, which consists chiefly of Salt and Sulphur, being separated in the Liver, and from thence transmitted to the intestines, serves for some use of Fermentation. For this being mixed with the Chyme or Juice, fallen from the Ventricle to the intestines, makes it there to grow hot and to swell up; whereby both the Elementary Particles are more overcome, and by reason of the Rarification or swelling up, the purer part is wrung forth into the Milky Vessels, for the Nutritious Juice.

We are not only born and nourished by the means of Ferments; but we also die: Every Disease acts its Tragedies by the strength of some Ferment. For either the Sulphureous and Spirituous part of the blood, being too much carried forth, boils up immoderately in the Vessels, like Wine growing hot, and from thence Feavers of a divers kind and nature are inkindled: or sometimes the Saline part of the blood, being too much carried forth, suffers a Flux; and from thence it being made acid, austere, and sometimes sharp, is apt for various Coagulations: from which the Scurvy, Dropsie, Stone, Leprosie, and very many Chronical Diseases arise.

Yea we also endeavor the Cure of Diseases by the help of Fermentation: For to the preserving or recovering the Health of man, the business of a Physician and a Vintner, is almost the same: the blood and humors even as Wine, ought to be kept in an equal temper and motion of Fermentation: wherefore when the blood grows too hot, even as Wine, it is usual to empty some out of the Vessels, and to allay its Fervor with temperat things. If any extraneous or heterogeneous thing, is mixed with it, unless growing hot of its own accord, it drives it forth of doors; Purging, Vomiting, and Sweating Medicines, by shaking and fusing the blood and humors, promote its seclusion: when that the blood is depauperated, and grows less hot than it should do, Cardiacks, Digestives, and especially Chalybeats or steeled Medicines restore its vigor and Fermentation: no otherwise than Wines growing sour or degenerating into a deadness or want of strength, are mixed with more rich Lees, whereby they may Purge or grow turgid anew. I could easily unfold the Curatory intentions, as also the effects and operations of every Medicine, according to the Doctrine of Fermentation; but I design a particular meditation for this thing: for the perfecting of which serious work, God willing, I have determined to add to the business of Medicine, as I hope, something not unprofitable.

Having thus far wandered in the spacious field of Nature, we have beheld all things full of Fermentation; not only in the distinct Provinces of Minerals, Vegetables and Animals, do we discern the motions and effects of this, but also the whole Sublunary world, seems as if one and the same substance were planted, and very pregnant through the whole with Fermentative Particles; which in every Region and Corner of it, as little Emmits in a Mole-hill, are busied in perpetual motion and agitation; they fly about here and there; sometimes upwards, sometimes downward they are hurried, they variously meet one another, associate themselves, and again depart asunder; with a continual Vicissitude they enter into divers Marriages, and suffer Divorces, on which the beginnings, the death, and transmutations of things depend: These little Bodies do not only very much abound in the bosome of the Earth, or in the midst of the waters, but they are especially diffused through the whole Atmosphere of the

Air in thick heaps. It is sufficient that I have noted in this place, some examples in a word: I have not determined a more full speculation of them here. It is time that we proceed from Physical things, to the works of Art.

C H A P. VI.

Of Fermentation, as it is performed in Artificial things.

IN the works of Art, so various and manifold provision of Fermentation is perceived, that it is altogether impossible to enumerate their several Species; or to reduce the divers instances of this to certain Classes or Heads of distribution. Making use of the third of the following method, we will subjoyn some examples, (which have happened to our observation) by whose rule, many others may be laid open.

Concerning Fermentation, which is made in the Subjects, made by hand, or human industry, these three things are chiefly to be considered.

First, of what Nature and Composition Bodies are, that are most fit for Fermentation, and which are less convenient for it.

Secondly, What things are requisite about Fermentation, to wit, what are wont to promote, or also to hinder its motion in every Subject.

Thirdly, How manifold the motion of Fermentation is, and the end of it; also what are the effects and alterations which follow it.

As to the first, That all Bodies, (when tending to perfection) may truly Ferment, they are required,

In the first place, That there be some parts loose and disjoyned; otherwise the Fermentative Particles will not be stretched forth, or move from place to place: Wherefore in the more hard compacted things, or in viscous things, or too much boyled, or evaporated to a spissitude or dryness, Fermentation does not succeed. What are Liquid, as Wine, Beer, the Juices of Fruits and Herbs, easily and quickly swell up; next to these what are soft, tho they are of a thicker Consistency, as Bread, and most Eatable things, and Medicinal Compositions.

Secondly, It is required that there be an Heterogeneity of parts, or a confusion of all the Principles together; to wit, that some Particles do oppose others, and stir them into motion. For the more simple Bodies, in which one, or at most two Elements only are strong, with a very small proportion of the rest, are unapt to Ferment: because like Particles, or Symbolical Elements, lie benumbed and quiet. But between the unlike, there arises presently a strife for domination, and some provoke others into motion.

Thirdly, There is a third condition, that there be neither too much Crudity, nor Maturity of parts, in the body Fermenting. In the former, the active and subtil Particles, are not easily extricated from the more thick, nor are brought into motion: as it appears in Juices, which are pressed forth from unripe Fruit; also in Beer which is made of Barly or Mault, not come forth or germinated. In the latter the Particles being made too volatile, are not contained in the bond of the mixture, but presently evaporate, and dispose their Subjects to Putrefaction. Wherefore, Juice expressed from Summer Fruits, or others too ripe, will not easily pass into Wine, but it will quickly corrupt. And for this reason, extravasated blood, milk, and urine, do not Ferment, but quickly putrifie.

As to the second thing proposed, there are many ways by which Fermentation is either promoted or hindred. The first and chiefest, is the adding of a certain Ferment to the body Fermenting; the Particles of which, when being first placed in vigor and motion, may raise up the others, idle and sluggish, in the to-be-fermented Mass, and may drive them into motion. But there is a two-fold Ferment; either absolute, which is the same kind of Body, in which the active Particles, being alto-

gether placed in their vigor, are notably in motion, and so whilst they are committed to the Subject in Fermenting, snatch with them into motion other Particles there of the every kind before sluggish: by this means Barm or Yest, beaten Eggs, and such like, stir up a Fermentation almost in every thing. Or the Ferment is respective, to wit, which consists of Particles, very much of one kind, which meeting other of another kind, in the Mass to be Fermented, grow hot with them, and so produce in the mixture a turgency or rising up of all the parts together. After this manner Saline Particles having gotten a Flux, grow very hot, with other Salines, either fixed or alchalisate; as appears when acetous Liquors are poured on Corrals, Harts Horn, shells of Fishes; also when the Spirit of Vitriol, and the Salt of Tartar, are put together, a great ebullition is excited.

There are some accidents and external circumstances, which variously conduce, either to the provoking or hindring the motion of Fermentation; of which sort, are chiefly the condition of the Ambient Air, the placing or laying up of the body Fermenting, and the means of conserving it.

The Southern Air (in which hot and humid Particles every where abound, which also entering easily any Bodies, obtain the force and place of a Ferment) impresses a notable motion of Fermentation in very many things: Wherefore in drinkable Liquors, it doth not only raise up at first, the force of effervescency or growing hot, but also for a long while after induces new swellings up in them being Fermented. On the contrary, the Cold and Northern Air, binds up, and very much fastens Bodies; and in very many things hinders the fusions, and flowings of the Elements, and oftentimes, either hinders Fermentation from being stirred up, or restrains it being begun. Also the hot Summer Air, because it too much moves the active Principles, drives away the Spirits and subtile parts, exalts the Saline, and Sulphureous into a Flux, and so perverts their equal motion; and either the Sulphur or Salt being too much carried forth, it easily brings to Bodies a rancidness or putrefaction, or a mouldiness; which nothing favours the business of Fermentation.

It is a vulgar opinion, that some select times of the year, to wit, those in which the Vegetables of every Kind flower, cause anew the motion of Fermentation in the Juices, and other things prepared of them, after they had Fermented a long time before; so that Beer, when the Barly, and Wines in the time that the Vine, flowers, conceive risings up, or new Fermentations: they say also, that Bread and Flour, when the Wheat is in Flower, is wont to become sooner musty and moldy: also that spots or stains of the Juices of Fruits, as the Mulberry, Blackberry, Raspberry, and such like, being in Cloaths, are wont to be gotten forth again, at that time when those Fruits are Ripe. Concerning these things, I ingenuously confess, that I have not made tryal of them, by my own proper observation; so as to dare to affirm it for truth in every part: I will therefore lightly pass them over, for it would both grieve and shame me (lest I should relate false things) to Philosophize concerning doubtful things.

Concerning the laying up of the Fermenting Body, these things are chiefly to be observed. When things first being to Ferment, that they are not to be shut up in too close Vessels, neither while the Liquors are hot, are they to be put into Bottles or Casks. For the Particles, at first boiling up, and as it were rarified, desire a very large space: wherefore the Fermentation of Wine or Beer, is begun in open large Vessels: but when they grow less hot, those kind of Liquors, lest the Particles being set and moved into motion, too much, should fly away from the Subject, they are kept best, either in a cold Cellar, or close Vessels. In the preparation of Vinegar, we observe the contrary, to wit, it is wont to be placed in a hot place near the Chimney or Oven, or exposed to the Suns beams: to the end that the vinous Spirit being depressed, the Saline part might be exalted into a Flux, and so might give a sharpness to the Liquor. There is another observation, that Liquors do Ferment better in wooden Vessels, than in Glass, or Stone: For by long infusion, some Saline little Bodies are got forth of the Wood, especially the Oaken, which promote Fermentation.

As to the third thing proposed, concerning this thing; although to speak properly, the motion of Fermentation, is only a carrying forth of the Principles confused together, from a state of Crudity towards maturity; and the end of it, is a tendency to the perfection of every thing: yet use or custom hath obtained, that this word is attributed to very many other motions of Natural things, and includes other ends, and effects, far different. Therefore when the Fermentative Particles in any Body, are

are greatly in motion, the alterations which follow thereupon, may be in some respect referred to these three Classes.

First, it either respects the exaltation, and perfection of the parts of the same Body; or the resolution, and corruption of them.

Secondly, Or the dissolution of the parts of another Body is intended; or the præcipation of those loosened.

Thirdly, By the motion and action of these kind of Principles, a coagulation, and also a congelation, now of the same Parts, now of different Bodies, are induced. It remains, that we briefly run through every one of these Species of Natural Motions, and ways or manners of Fermentation.

CHAP. VII.

Of Fermentation, as it is seen in the exaltation of Bodies, and tendency to Perfection.

THE Exaltation of the parts, is perceived best in Works, or in all things appointed for human use, forasmuch as they get a greater perfection and vigor, by Fermentation; as, chiefly Aliments and Medicines do: in many of these, we endeavour to carry forth the Spirituous Particles above the rest; and so to procure in the mixture, a grateful sweet tast, and other agreeable qualities; as we may observe in Bread, Beer, Wine, Cider, and many others: But in some, we strive to exalt the Saline part, the Spirit being somewhat depressed; as in Vinegar, Meath, Broths, also in Sauce, Pickle, or in Preserved things, which are made of Salt and sharp Liquors. We rarely on purpose carry forth the Sulphureous part above the rest, for from thence a stinking smell, and ingrateful rammishness, are wont to happen to eatable things. Among foods set apart for mans use, Bread, Beer, Wine, and Cider, have the first place; which owe mostly, whatever they have of virtue, or strength, to Fermentation.

Concerning the making of Bread, these things are chiefly to be observed: the Meal of Wheat, or Barly, or of any other Grain, being kneaded with common-water, is reduced to a mass, to be afterwards baked in an Oven. If there be nothing else added to this, it becomes forthwith heavy, and ponderous like Clay, clammy, and of an ingrateful tast, and of difficult digestion: but if in the kneading it, there be added a Ferment, the Mass presently grows hot, the bulk swells, and afterward being baked, it is made light, spongy, of good digestion and grateful to the tast. If you desire to know the reason of the difference, it is this. The meat of the Grain is imbued with a moderate proportion of Spirits, also of Salt, and Sulphur; but the Particles of these, are overwhelmed in the Mass, with a viscous humidity, being kneaded with water; so that they move not themselves mutually, nor are in motion: wherefore in the baking, some superfluous humidity evaporates; what remains is cleaving, viscous, and becomes pressed close like Clay, and ponderous. But when a Ferment is mingled with the Mealy Mass, the active Particles of the Ferment being first stir'd up into motion, take hold of their Companions in the Mealy Mass, and carry them with them into motion. By this means, whilst some move others, they shortly are all stirred up into Fermentation; tumultuating here and there, they compass and run through the whole Past or Dough, they subtilise and attenuate the clammy and terrene parts, and they lift up the mass, with the motion, and make it hollow, with little holes; which yet in the mean time, lest it become too spongy, and whereby the parts made hollow, and attenuated might more exactly be mixed, it is wrought with long kneading, then afterwards, before the Fermentation ceases, and before the hollowed parts sink close down, it is baked in the Oven. In the baking, the superfluous moisture evaporates, and moreover, very many Particles of Spirit, Salt, and Sulphur, fly away; wherefore, the mass becomes lighter, and less ponderous, in the mean time, those which remain in the Bread, being much exalted,

and brought to maturity, cause in it a laudable consistency, with a grateful smell, and taste.

The Ferment commonly used, is a portion of the Mealy Mass, and unbaked, which is kept, being imbued with Salt, to a sourness (it is called in French *Levain*, because it lifts up the Mass) or the flowring of Beer, or Ale, called Yest or Barm; or for want of these the lees or dregs of Beer, or beaten Eggs, are made use of. In the mealy Ferment, the Saline Particles having gotten a Flux, do chiefly predominate; as also in the faces of Beer: wherefore the Bread Fermented by these, is made harsh and somewhat sour: In the mean time, Yest being very big with Spirit, Ferments the Bread more potently, and brings to the Mass lightness, and a very grateful sweetness. Beaten Eggs abound with Spirit and a Volatile Salt, and do yet more cause the Bread to Ferment, and render it more Spongy: without doubt there may be other kinds of Ferments used; for whatever are big and turgid with Spirit, or abound with Salt carried out to a Flux, seem to be fit enough for this use.

Sometimes the mealy Mass is kneaded with Sulphureous matter, as Butter, Sewet, Fat, or such like, which being baked in an Oven, while it is hot, it is seen to be light and spongy, (to wit while the Sulphureous Particles, are kept in motion by the heat contracted in the Oven) afterwards, when this Mass grows cold, it becomes heavy, weighty, and very close: to wit, the ascititious heat being exhaled, the Sulphureous Particles, before carried forth, at length sink down; and when the Particles of the rest, not being excited into motion, the Mass therefore becomes as it were Infermentated: For in these kind of Subjects the Sulphureous Particles, because they are very viscous, hinder the motion of the rest, nor can they themselves persist in motion, longer than they are forced, by the actual heat.

Bread is sometimes made of the flower of Wheat, or Barly, that is Germinated or Maulted, which without any Ferment added to it, becomes so exceeding hot, that it cannot be contained in a compacted mass, but that in the baking it spreads abroad: the reason of which is, in such Flower, by the Maulting it, the active Principles are before placed in their vigor, and exaltation; wherefore in the kneaded Mass, when they are urged, by the heat of the Oven, they run forth inordinately, and force the more thick parts, hindring them, and as it were fling them down head-long. We have said enough of making Bread; we will now pass to Beer.

Beer is made of Mault or Barly, germinated and dried, which is performed after this manner: First, the Barly is put into common water for three days, that it may intumescie or swell, then (the water being let out from it) it is flung in a heap upon a dry floor, moving it twice or thrice a day, lest it grow too hot, until it begins to germinate, or bud forth, or put out little shoots of Roots. Afterwards, by frequent casting it about, it is hindered from germinating or springing forth any farther, and lastly, being lay'd upon a Kiln, it is made dry by roasting it; by this means, it yields a meat wonderfully sweet.

The reason of this kind of process is this; the Barly is permitted to spring forth, that its active Principles might be brought or set into their strength, or exaltation: for when it germinates, the Spirit, Salt, and Sulphur, at first asleep, and sluggish, do swell up or grow big together, and their sluggishness being cast off, they are prepared to exercise their powers. The other preparations, hinder the Barly from germinating further, lest that its Principles being very much loosned, should exhale too much, and fly away from the Subject. The Meal of the Barly thus prepared grows sweet, because the active Principles are set in exaltation like Fruit brought to a maturity: wherefore also the Liquor impregnated with this Meal, grows very turgid or big with Spirituous and Fermentative Particles; when the simple decoction of Barly, scarce Ferments at all, nor is kept long, but that it becomes musty, and insipid.

But Beer is made after this manner; upon the Meal of the Barly, prepared as above said, boyled water is poured, and is suffered to be macerated, or maled, for some hours, that it may be sufficiently impregnated with the active Particles of the germinating Barly, now placed in their vigour: This Liquor being satisfied or filled, is drawn off clear from its settling, and is lastly boyled, that it might get a something more thick consistency, and be able to be kept the longer: Then, when it is somewhat cold, it is Fermented, a Ferment, or the flowring of Beer or Yest, being put thereto, and so tun'd up in a Barrel. Concerning its Fermentation, these things are especial worthy of observation.

If it macerate with, or stand too long on, the Maulted Meal, the Liquor becomes thick and clammy; and afterwards will hardly Ferment or Work at all: the reason of this is, because the active Principles, in this work, are of a prompt motion, and move together with them, the earthy Particles; with which, if by a long stay, the passages and pores of the Liquor are filled; being too full, they are wholly obstructed, and as the contents in the Stomach, stuffed to a surfeit, scarcely Ferment at all.

If too hot, or too cold, the Liquor be put into the Barrel; as in the great heat of the Summer, or the cold in the Winter, Fermentation doth not rightly succeed: for by too much heat, the Particles are dissipated one from another, that they cannot, mutually take hold of one another, and so work; by too much cold, they are bound up and fixed, that they scarce enter into motion, neither perform it strongly.

When the Liquor of the Beer Ferments in the Vat, the active Principles do on every side explicate themselves, they precipitate in the bottom the more thick, and Earthy, being partly driven as it were into flight, and partly sticking to them, they lead them as it were Captive to the top, and there make hollow bubbles continually growing up, and bring them as it were to servitude. After a due Fermentation, the whole space of the Liquor is rendered clear and without dregs, in which the Spirits with a little Salt and Sulphur, do abound; in the mean time, in the settlement or dregs, a little of Spirit and Sulphur, with a greater plenty of Salt and Earth remains. So long as these shall be in their places the Liquor will be clear, sweet, and Spirituous, but if long kept, or not shut up closely in a Barrel, great part of the Spirits will fly away: in the mean time, by the defect of these, the Saline Particles being exalted, and having gotten a Flux, impregnate the whole Liquor, and make it sour; for when Beer, as also Wine, goes into Vinegar, it doth not happen because they are wholly deprived of Spirits, (for so they would degenerate into a tasteless thing) but because the Tartareous or Saline parts, are carried forth to a Flux, and infect the Liquor with their sharpness; in the mean time, the Spirits being less in power, are depressed, that they cannot resist them. Very hot weather, Thunder, the noise of great Guns, or the tuning it in the open Air, suddenly makes Beer grow sour, for by these means the Spirits being disturbed in their equal motion, are dissipated; and in the mean time, the Saline or Tartarous parts, being before separated, and depressed, are moved, and carried forth into a Flux.

Indeed it plainly appears that the Spirituous parts in Vinegar, are not wholly destroyed, but suppressed only whilst the Saline are placed in a Flux; because from Vinegar, may be Distilled, a Liquor exceeding hot and burning, like the Spirit of Wine, after this manner: With the Distilled Vinegar, a Salt is extracted from Minium, or Lead Calcined, of which you have plenty, and shall distil it in a Retort, the Vinous and burning Spirit is driven into the Receiver; the reason of which is, because when the Saline Particles of the Vinegar are united with the Salt of the Lead, the Vinous Spirits yet remaining are then freed; and having obtained their own right, they are urged from their lurking places by the heat of the Fire: but those Spirits are not produced from the Lead, because if you give thereto a more vehement Fire, the Salt of the Lead, will be melted into a Metal.

But we will return to Beer, from whence we have digressed; to which, how great a perfection happens, by Fermentation, appears by this experiment. If you take Beer new made, not yet purged by Fermentation, and place it to be Distilled in a Bladder or Cucurbit; only a vapid or tasteless water ascends, without any Spirits, and strength at all: but if you proceed after the same manner with Beer truly Fermented, you will have a hot water, and highly Spirituous. And this takes away the objection of some, who say that water being even impregnated with the Meal of Mault, should not be any more boyled, lest the Spirits should exhale; because the Spirits, before Fermentation, are so obvolved with the more thick Particles of the rest, that they cannot break forth from the Concrete.

The more the Beer is impregnated by the Mault, the stronger it is, keeps the longer without souring; which is helpt if Hops be boyled therein, from which at first it grows bitter, but afterwards recovers a grateful sweetness; the reason of this is because the pores of Liquor, which are empty of the Particles of the Meal, when they are possessed by those of the Hops, the consistency is made more compact, and is more full of Fermentative Particles; wherefore there is not quickly given any room for the Flux of the Salt. But that the Liquor being at first bitter, afterwards grows sweet, happens

happens for this reason; because the Spirituous and Sulphureous parts, supplied by the Meal of the Mault, come not so soon to Maturity, because of the others mixed with them from the hops being boyled therein: but when this happens, that they grow to maturity, they easily excel all the others, and impart a sweetness to the whole. Not only Hops being boyled in Beer, keep it long from sowing, but also many other bitter, or sharp things, do the same: for these, forasmuch as they exceed in a Volatile Salt, hinder the flowings of other Salt; wherefore, some are wont to put into the Barrel, a piece of Sassafras Wood, the tops of Wormwood, Broom, the Firr-Tree, the rinds of Oringes, also Spices in a small quantity; by which means, the Drink, tho of a smaller substance, is kept a long while from sowing. Thus much concerning the preparation of Beer, on the consideration of which, (as also of Bread) we have stayed long, because the word Fermentation is chiefly due to these. Let us pass next to Wines.

Excepting the Blood of Animals, there are no Liquors that grow hot, like Wines; there is found in none a greater plenty of Spirits, Salt, and Sulphur, or a more remarkable turgescentcy, or swelling up. The Fermentation of Wines, and the handling of them Fermenting, are wont to be taught among the Vintners or Wine-Coopers, as a secret only to their Apprentices, or the Adepti of their Art. Among them there is delivered a certain Physical Science, or Method of Medicine, by which means, the impurities of Wines are purged forth, their heats attempered, or also their defect, or sickness may be healed. There are many ways to be used, besides that of sophisticating, as a secret, by which depauperated and tasteless Wines are sold for sound and rich. But as to our proposition, that the Doctrine of Fermentation might be illustrated, these three things ought chiefly to be considered, concerning Wines: First, Their defæcation or cleaning, and their going into parts. Secondly, Their immoderate effervescency or growing hot, from what causes it is wont to be stirred up, and by what means to be suppressed. Thirdly, The declination of them, when they grow worse: and by what remedies they are kept that they do not quickly pass into a tastelessness or Vinegar.

1. As to First, That Fermentation may begin in the Must, there is not (as in Beer) required, the putting to any Ferment, for the Juice being expressed from the Grapes, doth so greatly swell up with active Particles or Principles, that it presently of its own accord, grows remarkably hot: but it is a usual thing in some regions, when the Grapes are trod, to besprinkle them with Quick Lime, by the provoking of which, as a Ferment, the Liquor pressed forth, grows more fervent, and is sooner purged. The Must or new Wine, is at first put into open Tubs, for that they cannot be contained in close Vessels, for their great heat or working, which so boyls up, that water over a Fire grows not more hot: when the Wine is a little cooler it is put into more close Vessels, in which it is further purged by Fermenting. In the purifying, the Spirituous and Subtile Particles greatly shake the more thick dregs, and dismiss them from themselves on every side, that the Mass of the Vinous Liquor, being made free from the mixture of the dregs, is rendred clear and without dregs. The Fæces or Lees of the Wine consist of Salt and Sulphur, with a little Spirit and plenty of Earth; which whilst the Wines grow hot, being separated by degrees, either by Coagulating themselves mutually, are affixed to the sides of the Vessels under the Species of Tartar, or like Lees or Mother, settle to the bottom. In the mean time the Liquor swimming over them, is very clear and exceeding Spirituous.

Sometimes the defæcation or clearing of Wines is hardly brought about, as a Vinous Liquor is not easily freed from the mixture of Tartar: wherefore Vintners are wont to put to the Wines some Bodies that either clear them, or precipitate them, so as the Earthy matter swimming in them, may sooner settle to the bottom: The things which so clarify Wines are of two sorts: for they have either viscous parts, as Glew, the Whites of Eggs and such like, which stick close to the fæculencies of the Wine with laying fast hold on them, and carry them with themselves towards the bottom: Or else they abound in a precipitatory strength, which while they enter into the pores of the Liquor, thrust forth the more thick Particles from thence, and strike them down to the bottom; as are the dust of Alabaster, Calcined Flints, and such like.

2. Wines tho at first they were well cleared, yet afterwards they conceive immoderate effervescencies, so that the Tartar, being stirred up from the bottom, it at length mingled with them; also the Spirits being loosened, now the Sulphureous Particles, now the Saline being too much carried forth, render the Wines unsavory, clammy

or fowr. We will consider these things, from what Causes they come to be so, and by what means they are Cured.

Wines very often contract heats, when they are full of Tartar or too rich Lees: For Tartar or Lees, tho separated from the Liquor of the Wine, and depressed to the bottom of the Vessel, yet for that they consist of plenty of Salt and Sulphur, they still send from themselves Fermentative Particles, by the inspiration of which the Wine is kept in an equal motion of Fermentation: and as the Wines are leisurely ripened, so the Salt and Sulphur which lurk in the Tartar, are by little and little exalted; until at length, being carried forth to a Flux, they infect the Vinous Liquor, with a troubled feces or dregs, and compel it to grow immoderately hot, and to boil up. Against these too great heats of Wines, there is a necessity, that they be presently drawn off or rack'd, from this too rich Lees, and put into another Vessel, or else it comes to pass, by reason of its too great disturbance, the Sulphur being very much exalted, that they become unsavory and ropy; or the Spirit being lost, and the Salt carried forth to a Flux, they contract a fowness, and turn to Vinegar.

Neither doth Wine grow more hot than it should do, only from Tartar, or too rich Lees, but by too great agitation, immoderate heat, or by an extraneous or strange Body put to it, and not miscible, or that cannot mingle with it: for by these and other ways, the Sulphureous part of the Wine grows hot, and from thence conceives a fervour, and undue boiling up; for the settling of which, besides the racking or drawing it off, from one Vessel into another, they use to pour plenty of Milk, into the Pipe or Barrel, by whose mixture the heats and tumults of the Wines are presently appeased; but as by this means the Spirits of the Wine are very much overcome, it cannot keep long, but soon after degenerates to Vinegar, or without tast; therefore the Vintners are necessitated to sell presently the Wines mended by this Artifice, and very suddenly to draw them off.

These kind of heats of Wines, tho they be timely appeased, before they wholly spoyl the Wines, yet they leave some viciousness, by which the Vinous Liquor is altered from its due colour and consistency, and is made less grateful to the Palate: for Wines made hot, oftentimes become of a more deep colour, *viz.* they degenerate from a watery and clear colour, to a Citron or Red, and give to the tast a rankness; all which indeed proceed, from the Sulphur being too much carried forth and exalted: For these kind of distempers of Wines, they proceed after this manner; for the mending the colour, oftentimes simple Milk, or boiled with Glew or fine Flour, is poured into the Hogshead or Pipe; for these procure a certain separation of the exalted Sulphur, and with its whiteness give a clearness, or restore the colour to a brightness. Mucilaginous, clammy, or ropy Wines, are amended by the infusion of burnt Alum, quick Lime, Gypsum or Plaster of Walls, Salt and the like; for these cause a new Fermentation, that the more thick Particles are thrust forth from the rest, and precipitated towards the bottom. The unfavouryness is helped by the same means.

3. As to the third proposition; Wines are depauperated or made poor, when by a long effervescency the Spirit and more pure Sulphur, being exhaled, the Saline Particles begin to be exalted: in this case their languishing strength is sustained with certain remedies, as it were Cordials.

As the Spirit and Sulphur being too much carried forth, and exalted, is cured by the drawing off the Wines from the rich Lees: So the same being depressed, the remedy is that they be put to a more rich Tartar or Lees: wherefore the Vintners, are wont to pour the depauperated Wines, destitute of plenty of Spirits and Sulphur, and which begin to grow fowr, by reason of the Salts being carried forth to found and fresh Lees or Tartar; that they might as it were anew inspired with Spirit and Sulphur, ferment and recover new strength and vigor, besides they make Syrups of generous and rich Wines, with Sugar and Spices, which they pour among the stale and deadish Wines. Further, for Wines turning to Vinegar, they are said to administer profitably, some other remedies. *Gratarolus* praises with many more, Lard and Swines flesh salted, wrapt in Linnen, and put into the Cask: and truly it is probable that the Sulphureous odor of this doth restrain the Flux of the fowring Salt; for this end the same Author commends Leek-Seed, Pine-Nuts, blanched Wheat, boiled Wine, Ashes, the shavings of Willow, and many others, for the Salt readily acts on these kind of Subjects, and spends its force; even as Virgins sick of the Green-sickness,

sickness, desire greedily to eat such like absurd things, that may satisfy the extraneous, and for the most part sourish Ferment of the Ventricle, but very hurtful to themselves. There remains another kind of Cure, whereby small Wines almost corrupted, and growing vapid or smachless, recover new vigor for a time, to wit, a portion of Rhenish Wine, or others, very Fermentable, is laid up, and hindered from Fermenting, from whence it is made a perpetual Must (commonly called Stum) if a little of this Liquor be poured into a Cask of stale Wine, and jogged together, it gives a fresh, and new Fermentation to the whole: so that that Wine will froth and boyl, and shut in a Glass will leap forth; but the drink mended by this Artifice, is accounted very unwholsom, for that it is apt to stir up an immoderate Fermentation in our blood: wherefore it is prohibited by Edict, that the Wine-Coopers or Vintners make not use of this kind of Sophistication.

It is a usual thing also, to stop up close, in Stone or Glass Bottles, for a time, small Wines, and new Ale or Beer, which being afterwards opened, the Liquor ferments so impetuously, that being almost all rarified into froth, it flies forth of the Bottles: which besides contracts such an acrimony or sharp cutting, that it can scarce be swallowed: The reason of which (as it seems) is this: The turgency or swelling up, and the notable acetosity, sharpness, or quickness of these kind of Liquors, proceeds chiefly from the Salt being exalted, and having gotten a Flux; for when as the Liquor, being full of much Tartar and little Spirit, is shut up close in a Vessel, all the Particles together are forced to be fermented, and when they cannot be separated, and fly away from one another, they do the more trouble one another, and break themselves into small bits; that by this means the bond of the mixture may be wholly broken; but the little bodies loosened one from another, and as it were freed by reason of the closeness of the Vessel, are forced together: wherefore when the Vessel is opened, all the Particles at once being ready for flight, like Air suddenly rarified, break forth with noise and tumult; and because the Saline parts having gotten a Flux, by reason of the plenty of Tartar, are stronger than the Spirit and Sulphur, from thence the notable cutting sharpness is caused in the Liquor.

Cyder comes next to the Nature of Wine, to wit, of the smaller sort, which kind of Liquor, is only the Juice pressed from Apples, and brought to maturity by Fermentation: concerning this kind of Drink, it is worth observation, that if it be made of Summer Fruit, or too much ripened, it will not keep in strength, but presently degenerates into a deadness: but if it be prepared of very unripe, and sour Apples, it contracts a bitterness, for that the Spirits do not sufficiently arise in this, but give place to the Salt, having first gotten a Flux: but in the other, they are not long enough retained, but wholly fly away, before the mass of the Liquor attains to full Fermentation: but there are Fruits and Apples, exceeding fit for this business, which being indued with a more firm consistency, are not quickly corrupted, neither do they attain their perfect maturity or softness, but of a long time: The Juice of these wrung forth, and put into a Cask, does not grow hot, as Beer, with a great frothy head, but after the manner of Wines, with a noise, like a Pot boiling over the Fire: whilst Fermenting after this manner, it is made clear, the more light recrements, are carried upwards, and remain in the Superficies, as the flowering: but the more thick parts and Tartarous settle plentifully in the bottom; but the more solid Crust, or Coagulated Tartar, is not fixed to the sides of the Vessel: which is a sign Cyder is a more wholsom Drink, nor so infectious to the nervous stock, because it abounds less with a sharp Salt than small Wines. The Liquor swimming over these Fæces or Lees settling in the bottom, enjoys it as it were its food, and is kept by its inspiration in strength; from which, if it chance to be drawn forth, it quickly grows sour: for indeed this kind of Drink, is in great danger to be destroyed by the Flux, or sourness of the Salt: against this ill, to preserve it, some are wont to cast into the Cask Mustard Seed bruised, or Mustard Balls, for that the Volatile Salt of this hinders the Flux of the acetous Salt, so that the Liquor thereby presently grows clear, and keeps the longer: another kind of remedy against the sourness of Cider, is, that as soon as it begins to grow sour, it be drawn off from its Lees, and kept in close stoppered Bottles, with a little Sugar; for by this means it ferments anew, and because, together with the Flux of the Salt, the Spirits being carried forth, are detained from flight, a very grateful sharpness is caused to the whole Liquor. Also, almost by the same preparation, and the like process of Fermentation, a potable Liquor is made out of Pears, which is however above measure sweet, and if plentifully drunk, renders the Belly loose, as if they had taken Physick.

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So much for Fermenting Liquors, whose virtue consists in the Spirit being carried forth, and obtaining the height of perfection: there remains other preparations, whose vigor is placed in the Saline part being exalted, and having gotten a Flux; among these, Vinegar is of chiefest note, the way of making of which, being wholly unlike the aforementioned, requires a method of Fermentation, very different from those before described: for example, small Wines, or more generous or strong Beer, being put up into the Cask, are exposed in the Summer time, for a long while to the Suns Beams, or else in the Winter, they are kept near a Stove in some hot place; after this manner, whilst some Spirits evaporate, the rest being put under the yolk, the Saline parts are exalted and infect the whole Mass of the Liquor with their sharpness: but not only Wines long kept, or Stale Beer, out of which the Spirits of their own accord, begin to go away, but fresh Must, or new Beer, pass after this manner into Vinegar; for the Country-women are wont to place without doors all the Summer, strong Ale, and highly impregnated with Mault, in a Cask, by which means they make an exceeding biting and most penetrating Vinegar.

Yea after the same manner almost, our kind of Hydromels, Honnied Drink, or Meath are wont to be prepared: to wit, they boyl sixteen parts of Water with one part of Hony, to the consumption of a third part, adding then some Spices, together with a sharp Ferment, they place the Cask and Liquor for many days in the Sun, and afterwards in a Wine-Cellar. It seems the Sunning of it is used, that thereby the Saline parts being brought towards a Flux, might somewhat restrain the nauseous sweetness of the Hony: and by that means the sweet being tempered with sharpness, a most pleasing tast is afforded to this Drink.

By reason of the sharpness arising from the Flux of the Salt, also very many eatable things are wont to be prepared after various manners; hence the flesh of living Creatures, and especially of Fishes when they swell with too much Sulphur, are pickled with Salt Brine or sharp Liquors, that the Salt being brought forth, they may become more grateful to the Stomach. It would be a tedious business to insist here on particulars; but I will in this place describe a certain noted kind of Oaten Broth, Grewel, or Flumery, which profitably nourishes Feverish, also Consumptive and Hectick people.

This kind of Drink, that it may become gratefully sowerish, the Meal of Oats is put into common water for about three days, till it acquire a somewhat sour tast: then, this infusion is placed upon the fire, and with a Ladle is stirred about until it boyls, and when it rises up ready to flow over the Vessel, it must then be poured forth into a platter, and presently cooled; it will appear like Gelly, and may be cut into bits; which if heated soon melts. In this preparation may be observed, that by a long infusion of the Grain, the Saline parts being brought forth, do get a Flux; then these so impregnate the Liquor that the more thick Particles being by the heat brought into its pores and passages, they are so strictly shut up, that they cannot easily sink down, but that the whole mixture becomes like Gelly.

It would also be too great labour to heap together here, the various Condites and kinds of Pickles, for it would be to describe under that rank the whole Art of Cooking and Diet. For in both the only aim is, that for healths sake and for pleasure, the active Particles in our food, may be placed in their vigor and exaltation; for so they greatly please the Palate, and by a more easie digestion go into nourishment: for this reason, not only Drinks, and Confections of Corn, and Herbs of a diverse nature and kind are thought on; but also we variously prepare flesh, both boyled and roasted, and add to them sauces, that the Particles, now the Spiritous, now the Saline, being carried forth to a Flux, might please the tast, with a certain sharpness. Those which are of a more fixed nature, are brought to exaltation, by Sauces made of Sugar, Salt, or Pepper. They are wont to keep some flesh almost to putrefaction, that by that means, the active Particles being placed in their strength and motion, may become of a more grateful tast. Here might be interwoven, a long discourse concerning Medicinal Compositions, but because this subject, deserves a peculiar consideration, I will say nothing more of it here. Let us next see by what motion of Fermentation and Habitude of Principles, Natural Bodies tend towards dissolution; or what is the progress of every thing to Putrefaction and Corruption.

C H A P. VIII.

Of the motion of Fermentation, which is observed in the Death, also in the Putrefaction and Corruption of Bodies.

Natural Bodies in which Spirit, Salt, and Sulphur, are found in but a mean quantity, do not stay long in the same state: for these active Principles are employed perpetually in motion: As soon as they come together, they tend from Crudity and Confusion towards Perfection, for the sake of which, when they have reach'd the height, they are able to come to, they are not quiet in this point; but from thence they make hast towards the dissolution of that thing. Those which are more volatile do first of all break forth from the loosened bond of the mixture; then the rest separate into parts, until the form of the mixture wholly perishes: The Spirit being carried forth to the top, flies away first with the water, and the more pure Sulphur, and by its expiration, diffuses a very grateful odor; afterwards the more thick Sulphur, with the Salt, being loosened from the band wherewith they were tyed, and having gotten a Flux, by degrees evaporate, and together disperse a very stinking smell: together with these, the watery parts flow forth, and the frame of the subject breaks, or falls down into Earth or a *Caput Mortuum*.

This kind of process may be observed both in natural things, and also in Subjects prepared by Art: Concerning Natural things, the disjunction of the Elements, and their separation into parts, may be seen both in the death of living Bodies, or the extinction of life and vegetation; and also in the corruption of them being dead, and in their reduction to a rottenness.

As in Vegetables, the growth and maturity depend on the combination and mutual cleaving together of the Principles, so the decay and death depend on their going asunder, and separation, in Plants and Fruits; being by degrees exalted from a crude and sour Juice by Spirit and Sulphur, they come to maturity; to which a sweet tast and smell, and a pleasant colour happen: then presently the same matter, the Spirit and Sulphur, and the rest of the Elements leisurely flying away from the subject, is soon reduced to a filthiness and rottenness: If after the subtil and more pure Particles of Spirits and Sulphur are flown away, there still remain plenty of Earth and Salt, with some Sulphur, the matter does not putrifie, but grows dry with an hoariness: but if the thick Salt and Sulphur, having gotten a Flux, break forth from the Subject, together with the rest, the bond of the mixture being loosened, presently the external humidity, possesses the spaces left by these, and the Body is resolved into rottenness.

Also all Animals whatsoever, have set bounds of their growth and duration: For they ascend from their beginning, by slow increase, to motion and sensation; then to the strength and exaltation of Nature: in which point they stay not, but from thence, by equal steps, make hast towards their fall.

If the cause of this kind of limitation be required, we say that Mother Nature hath placed in the primigenious seed of every thing, such a stock of Spirit, Salt and Sulphur, which might suffice for the producing the utmost thrids or lineaments of Bodies: so that the growth and ascent of the thing, to its height or *acme* is only an evolution, or unrolling of that radical matter, and protension or stretching it self forth into a greater dimension; in the mean time the little spaces and vacuities, which are made by the protraction of this matter, are filled up by the active Particles, supplied by Nutrition, which also by a continual series of motion are ripened, exhaled, and give place to others succeeding. As soon as this seminal matter is unfolded and exalted to the height, that it cannot be moved, or expanded further, the matter is then brought to the state of its perfection: from thence some Particles of this Radical substance, together with the secondary supplied from the Nourishment, begin to evaporate; and others daily, and then others, being after this manner consumed, both
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the solid parts, by degrees decrease in their substance, as also the Nutritious Juice and Blood, even decline for the worse, till by a long wasting, the props of the Body, are made dry or withered, and the blood so depauperated, that it will not suffice for sustenance to the vital fire: just as it may be perceived in a Lamp, if the Oyl being continually consumed, in its place be put water, the Liquor is rendered poor, and diluted, that it is not able any longer, to cherish at all the flame of the wick.

When the Life of Animals perishes, (either it expires after the aforesaid manner leisurely, and like a Candle or Lamp is extinguished, the Oyl or Tallow being consumed; or it is choaked by a hasty death, being snatched away by Fate, or the violence of a Disease) presently the Spirits, with Salt and Sulphur, flowing together in the blood; and also planted in every part, cease from their regular motion, and are moved into confusion: then they partly exhale from the pores, with the vanishing heat, and partly being shut up within in the Cavities, inordinately Ferment, with the remaining Particles, and make a swelling up of the inwards, and of the whole Body. But afterwards the frame of the solid parts being by degrees loosened, and the Sulphureous Particles, together with the Saline, having gotten a Flux, begin to evaporate; from thence a strong stink and corruption arise. The active Principles, breaking forth by heaps, do often mutually take hold of one another, and being combined in the superficies of the Carcase, produce Worms: at length when they are wholly exhaled from the Subject, what remains falls into dust.

It is a usual thing for Worms to be generated in Vinegar when it is corrupted and lost its strength, which being exceeding small; and somewhat long and smooth like Eels, swim in the Liquor, and may by the help of Glass be exposed to our Eyes; these being seen, it is commonly said, that the sharpness and pricking of the Vinegar proceeds from these little Creatures, which is a vain thought that deserves not a refutation; for they are only to be found in dead Vinegar; and I pray from whence have they their teeth sufficient for the gnawing of Iron? But the whole corrosive force of Vinegar is more truly referred to the Salt having gotten a Flux: in the mean time those little Creatures seem to be begotten by this means; it is sufficiently known, that when very many Subjects are brought to putrefaction, the active Principles being thrust out of doors, yet still affecting their old dwelling, remain somewhere about the neighbourhood, and being joyned together, do often produce living Bodies; wherefore, when moist things putrifie, most often little Worms grow on their Superficies; but in Vinegar the business is a little different, to wit, because the Elementary Particles are more fixed, therefore when the mixture of the Liquor is wholly dissolved, the active Principles, although loosened, yet breaking very hardly and difficultly from the substance, meet together in the bowels of the Subject, and there mutually cherishing one another, cause those little Creatures in the midst of the waters.

Also the Bodies of living Creatures, being prepared for our Food, are disposed towards putrefaction, if they are put up for some days, till the active Particles are loosened, and begin to be in motion, tending to exhalation; wherefore both the Flesh becomes more flaccid, and in eating more tender and soft: and if they are kept longer, till the Saline and Sulphureous parts being carried forth into a Flux, do break out, presently a stinking smell and putrefaction is induced.

There are many ways whereby flesh is wont to be kept from putrefaction; the chief of which are, that it be pickled with Salt or Spices. Things are kept a long time incorrupt and very grateful to the tast, with Salt: Dead Carcases are imbued with Spices, that they may remain a long while in their Sepulchers. As to the first, Brine or salt Pickle hinders the eruption of the Sulphur, and fixes it in the Subject by its embracement, and retains it. Spices, as they consist of very active Principles, stir up a new Ferment in the Subject, the dead Carcase; and the implanted Elements of this, joyn into the society of their motion, and retain many of their Particles flying away, yet longer in the Body: As Salt and Spices are made use of for the preserving long flesh, and Sulphureous things; (which also preserve all other things from Putrefaction) so Vegetables, and their Flowers and Fruits are better conserved with Sugar: for this by cherishing the active Particles of the Subject, restrains them within, and besides, renders the Confections, of a very grateful tast.

Minerals, chiefly the solid and hard, because they are indued with plenty of Salt and Earth, with little of Sulphur, and with a less quantity of Spirits, therefore they rarely, or not at all conceive Putrefaction: there is the same reason for resinous things, which tho they abound in Sulphur, with Salt and Earth, yet because there is but a

small portion of Water and Spirits, therefore their frame is not easily loosened, neither are they obnoxious to Putrefaction. Among Minerals, Common-water only, falls under this rank: for this, if it stand still, or is kept long in a Vessel, its Salt and Sulphur, though but in a little quantity, having gotten a Flux, begin to evaporate, and together to induce Putrefaction: but so long as water is in motion, these Particles are still involved with others, and so by their mutual embrace, are detained from evaporation.

Artificial things and preparations, are no less subject to Putrefaction than Natural things; for Bread, and all manner of Eatable things or Food, Wine, Beer, and other Drinkable Liquors, also Medicinal Confections, being long kept, first lose their strength and vigor, and then afterwards are Corrupted: concerning which, we may observe these following things.

The more the things are Compounded, and have all the Principles conjoined together, the sooner, and the easier, do they enter into Putrefaction; wherefore Eatable things, prepared of Flesh, Broths, Decoctions of Herbs, also many Medicines made after the Galenical way, are wont (unless preserved with very much Salt or Sugar) to be Corrupted in a short time: In the mean time, Distillations, and Chymical Preparations, which consist of Homogeneous, or not much different Particles, are kept sound a long while.

In Compounded things, if there be too great quantity of water, things sooner putrefie, for so the frame of the mixture is too loose; so that the fixed Principles cannot take hold of the Volatile, or keep them back from flight: but those in which Spirits abound with moderate Salt and Sulphur, if they are kept in a close Vessel, that they may evaporate but little, continue a long time, as may be perceived by strong or generous Wine. The next to these, are those things which are preserved with Honey or Sugar, or in which the Saline Particles are in in great plenty by Nature.

Many of these, whilst they are corrupted, are either made Moldy or Rank, or they grow sower, or degenerate into a vapidness, or without taste: things are made Moldy, when the subtil Particles in the exhaling, are detained by the more thick, and cleaving together by their mutual embrace on the Superficies of the Body, grow into a soft Down or Hoariness, even as Moss is brought forth by Stones or Wood exposed to moisture.

Rankness or unsavory Taste, happens chiefly in Sulphureous things, for Oily and Fat things, by Heat or Age, become Musty or Unsavory, to wit, when the Spirit being very much exhaled, the Sulphureous Particles are too much exalted, and begin to evaporate.

Sharpness or Acidity is induced from the Salt, being too much carried forth and loosened, for when the Spirit is depressed, or exhaled, the Salt being fused, conceives a Flux, and so brings in a Sourness: hence Wine, Beer, Cydar, also Milk, very many Eatable things, and the Juices of Herbs, when they are long kept, or if they are moved by too immoderate heat of the Air, or shaking, do easily grow Sour.

Liquid things, degenerate into a vapidness or tastelessness, when the active Principles, are for the most part gone forth, and nothing eminent besides Water and Earth, or of the subtil parts, is left in the Subject.

That I may contract what is aforesaid; the corruption of every thing, is only the separation and departure of themselves from one another into parts of the Principles before combined, (the bond of the mixture being loosened) which motion, by reason of the diverse disposition of their breaking forth, (either with or without a stink) ends in Putrefaction or Rottenness.

Where Spirits abound, and that there is also plenty of Sulphur and Salt, and the Particles being loosened from their bonds, break forth in heaps; the mixture putrefies with a stink; also if it consist of a thick substance, so that all the parts are not rightly ventilated, it conceives a heat from the Putrefaction: in such a Corruption, the stink proceeds from the exhalation of the sharp pointed Sulphur, or made pricking with the Salt: Putrefaction follows, for that the external humidity, enters into the place of the Particles flying away: But the heat is produced by the Sulphureous Particles being moved together in heaps, and being shut up within the Subject, that they gather together, and being united act more strongly. But if there be in the Subject a lesser proportion of Salt and Sulphur, so that when the mixture is loosened, the Particles are moved more slowly, and evaporate leisurely, the Body grows dry, and is reduced to a wasting, without any ill smell, Putrefaction or Heat.

It will not be from the purpose to inquire in this place, from whence some empty Vessels, and more moist bodies, by lying long, conceive a certain stink without Putrefaction; also other things being put into them, or lying near them, are wont to partake of their Evil; for which affection, a proper Latin word is not easily to be met with; in our Idiom it is called Mustiness, and in some sort seems to be designed by the word *Mucor*, unless that *εμεως* or *Mucor*, points at Bodies infected with a certain Down or Hoariness, (which we call Moldiness) which here never happens. The consideration of this matter is not improperly referred to the Doctrine of Fermentation, for this Tincture or Impression of a stink, unfolds it self far abroad, as if it were a certain Ferment, that the Vessel but lightly imbued with it, infects whatever Liquors are put into it, and infusions of them, even new and often iterated; we may observe a twofold effect of this thing: For sometimes the Vessels being almost empty, at first vitiated, afterwards infect most Liquors, which they by chance receive, with a musty odor: sometimes more moist compacted, and solid things, being kept long, somewhat close in a Cellar, contract this vice of their own accord; when in the mean time the contagion is not perceived to be in the place where they were kept; which things either may become musty, not because they are corrupted, for in most Spirit, Salt, and Sulphur, being yet contained, in the bond of mixture, the frame of the matter is kept whole, but the vice only consists in this, that from the Subjects after this manner disposed, *effluvia's* as it were aculeated or sharpned fall off, and therefore become ungrateful to our smell and tast.

First, that any Vessel may conceive a mustiness, there seems to be required in the first place, that its inward hollowness be large, and its mouth narrow; to wit, whereby a passage may lie open to the outward Air, and rest may be granted to it being entred in: for Juggs with broad mouths, also Bottles close shut, do not easily get this fault. Secondly, that besides the more ample inward hollowness, the sides of the Vessel be indued with pores, and very small passages; for in these kind of little spaces besmeared with humour, the Air being strictly shut up, remains more quiet, and is apt to stagnate: Wherefore Glass Bottles are not so apt to suffer this evil as Wooden, or Stone Bottles. Thirdly, that some moisture, tho very little, stick about the sides of the Vessel, or in its bottom, whereby the Air being entred may be intangled: for if the Bottles be hung up, with their mouth downwards, that all moisture may drain out, they will never be musty.

In the second place: when Bodies, without any contagion of a Vessel, contract a mustiness or moldiness of their own accord, we may observe, first, that they are of that kind, which consist of Heterogeneous Particles, that is, a mixture of all the Elements together; because the parts of Vegetables and Animals, and preparations of them, easily receive this evil; Minerals for the most part remain free from it: Secondly, that there be plenty of humidity in the concrete, for the more dry continue a long while without any hurt: Thirdly, that the Bodies be either kept in a heap unmoved for a long time, or else in some close Cupbord, or Cellar, without Air; for so Wheat or Grain, in a heap, unless it be often moved, as also all Eatable things, being put up in a close place quickly grow musty.

According to these positions we conjecture, that mustiness is made an affection to a moist inanimate Body, from the ambient Air, being admitted within its pores, and being got in there stagnating, whereby the Elementary Particles of that mixture, being combined together with those sent in by the Air, are exalted into the Nature of a Ferment; that they diffuse themselves on every side with wonderful activity, and their *effluvia's*, as it were sharpned, ungratefully strike against the sensories of the tast and smell. When therefore, some Subject becomes primarily musty, a certain portion of the Air placed near, and hindered from ventilation, enters into its pores and passages, and there being intangled with a tenacious matter, is wholly shut up within the substance of that Concrete. From the mixture of the shut-up Air, the implanted little Bodies of the matter, especially the Sulphureous and Saline, acquire new heads; that afterwards, when they are exactly to be mixed with no other Body, yet very greatly Fermentative, tho intermingled with any other thing, retain their own Nature, and being diffused through the large substance of the matter, infect the whole; to wit, they dispose by that means, the Particles of that new matter, that they being armed with sharp points, bring in like manner a trouble to our senses: But in the mean time, from the mustiness, whether primarily arisen, or received by Contagion, the mixture of the thing is not dissolved, nor the Principles dissipated;

yea those things which are wholly tasteless, do scarce at any time become musty : the musty smell depends chiefly on the active Principles, disposed by a peculiar rite, by the involved Air and their *effluvia's*; wherefore, if they almost wholly fly away from any Subject, that is rendred almost incapable of this affection.

There may be observed a certain likeness between mustiness and an Empyreuma, or taste of fire or burnt-too, for as in this, the Particles of the fire being intangled, and included by a tenacious matter, by their long stay there, pervert the implanted little Bodies of Salt and Sulphur, from whence their *effluvia's*, strike our Senses with an ingrateful sharpness; moreover, being mingled with other things, they affix to them, the disposition of their pravity; so in mustiness, the Particles of the Air, being obvolv'd with a viscous matter, and stagnating, they change by their presence the Saline and Sulphureous little Bodies; from their due temper, whereby they being as it were gifted with sharp prickings, do strike bitterly our sensories, and being exceeding Fermentative, diffuse their Odor to others : the alteration being either way contracted, can scarce be blotted out, by any mixture with other things, or emendation by Art : The chief means of helping of either, is by placing it in a reciprocal trajectory, *viz.* Empyreumatical things, or tasting of the fire, are to be a long while exposed to a more moist Air, whereby the Particles of the Fire may exhale : and musty things are to be held to the Fire, or put to such things which may sweeten their Nature, to wit, quick Lime, Sulphur, or Stygian waters, by which the parts of the included Air are driven away, and so the remaining little Bodies of the mixture are wont to recover their pristine state; wherefore, if musty Liquors are distilled, the water falling into the Receiver, will be deprived of that stink : But the smatch of Fire or Empyreuma, is not so easily mended by this Artifice.

So much for Fermentation, and the motion of the Principles, for as much as within the Confines of the same Subject, they dispose it, either to maturity and perfection, or towards dissolution and corruption. It now follows to treat of the motion of the samekind of Particles and Principles, for as much as some of one Body do act on others of another Body, and by dissolving the mixture, do wholly draw them forth, and send them outward, or by precipitating it cause them to go into parts,

C H A P. IX.

Of the motion of Fermentation, as much as is to be observed in the Dissolution of Bodies.

FOR the Solution of Bodies, there are two great solvencies, or Menstrua, which exist from Nature, to wit, Water and Fire : Fire, if it be next and immediately applyed, destroys most Bodies, drives away the Principles one from another, and as it were dissipates them into Air, Earth only, with a little Salt, being left behind; if it be mediately applied, it brings away some Particles, so that in the mean time others remain : After which manner it serves chiefly for Distillations, and Chymical Operations, and is also used in the Preparation of necessaries for our Food, both about the Boyling and Roasting of Meats. Water does not so readily destroy Bodies, but it draws forth some parts from the Subjects, and receives them into its own Bosom, and firmly retains them for various uses : But as it does not easily penetrate every Body, but leaves almost untouched those which are of a more fixed Nature, various ways are thought of, whereby the Menstruum of water is made sharper, and is rendred fit for the dissolving of any Bodies whatsoever. For by means of the Bodies, which it ought to dissolve, and of the parts which it ought to receive in it self, it is armed as it were with some Weapons; with which it is able to unlock any Subject, and to possess now these, now those Particles. The Menstruum of water is sharpened with Spirit, Salt, or Sulphur : to wit, either with each of these, or with more of them joyned together; we will first speak of the watery Menstruum, with the various sharpening of it, and afterwards of the fiery dissolvent.

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Common water most easily dissolves the more simple Bodies, except Sulphur; and hides their Particles, in its pores and passages; it readily receives Salts of every kind, and easily imbibes Spirits; it loosens the frame of Earth, and cherishes its more tender little bodies, in its embrace; but it is hardly mixed with Fat, and Oily things, and receives not their Particles, but by the coming between of others, but drives them forth to its Superficies, as not miscible, or thrusts them down to the bottom.

Water in some measure enters the more compounded Bodies, whose frame is somewhat loose; and then receives into its bosom, some not simple Particles, but resembling the nature of the whole mixture: hence most Vegetables, also parts of living creatures, and some Minerals, being put into common water, do impregnate it with a certain virtue; and from most Metals, by a long maceration, it takes away some strength, though but small. Some Bodies are dissolved by water, which yet a Sulphureous or Spirituous Menstrua leave almost untouched; as the Gums *Tragacanth*, *Arabic*, &c. also Salts and Sugar.

The first and most common way of sharpening, whereby simple water may more easily enter the Bodies to be dissolved, is, that it be furnished with fiery Particles, or darts of adventitious heat; for so it is driven more deeply with a certain force, into Bodies, and destroys some thrids, as it were the smallest mites, in their most inward recesses. Wherefore we are wont to boyl for a long while, the matter to be dissolved in water, or at least to infuse it in warm water, by which means, the more tenuious, and certain subtil Particles, which resemble the nature of the Subject, are easily drawn forth, and impregnate the water, with the virtue of the whole mixture.

So much for the simple, or natural *Menstruum* of water, to wit, for as much as its activity is wont sometimes to be promoted, by fire or ascititious heat. But this cannot be so simple, but that it contains in it self some Particles of another kind; as may be gathered from its easie Putrefaction; for oftentimes it is impregnated with Spirituous, Sulphureous, or Saline breathings, contracted from the Air or Earth; that for the drawing forth the tinctures of very many things, sometimes it excels an Artificial *Menstruum*; for that Acidulous or Spawish waters, Mineral waters, Rain water, and May Dew, are of frequent use among Chymicks, for the remarkable faculty of dissolving, with which they are strong. Besides, 'tis a vulgar observation, that some waters most easily dissolve Sope, and being thoroughly mixed with the same, causes in the liquor a great spume or froth; such, if they be rubbed between the fingers, feel soft and gentle; but other waters, which being handled with the hands, are more harsh, refuse the mixture both of Sope and Oyl, and so are accounted unprofitable for the washing of Cloaths: these sort of waters, if they should be evaporated in a Glass, oftentimes affix a Crust to its bottom and sides; because they are impregnated, more than they ought, with Saline Particles, with which, when the Saline parts residing in the Sope combine, the Sulphureous are carried away, and they being excluded the pores, are thrust forth as not miscible, to the top of the Liquor. When Flesh is boyled in these waters, it grows very red; which tincture indeed being thence contracted, is a sign, that those waters are somewhat imbued with Vitriol, or some other kind of Salt. But we will pass to Artificial *Menstruas*, in which the watry Liquor is furnished with Spirit, Salt, or Sulphur, being gathered apart, or many of them together.

The Spirituous *Menstruum* of water is made, when from a Body swelling with Spirits, a clear and limpid water is distilled; as from Wine, or strong Beer, or other Bodies truly Fermented, and brought to exaltation: The kind of dissolvent is hardly to be had so sincere, but it is mixed with the Particles of more pure Sulphur, and sometimes of a volatile Salt. The former kind of Liquor is called Spirit of Wine, which being subtil, and very penetrating, easily enters the Bodies, and parts of Vegetables, and also of living Creatures, but hardly Minerals, or not at all: it extracts from many things, not any Particles, or resembling the Nature of the whole mixture, (as common water) but chiefly Spirituous, and Sulphureous, the rest being almost untouched; wherefore, it is wont to be used for the resinous *magisteria* of Vegetables, (which it draws forth almost sincere or without mixture, under the form of Gum or Refine) in the mean time, it is not so fit as common water, for the extracts of Plants, which are not so indued with Sulphur: from Sulphureous things, as Benzoin, Sulphur, Olibanum, Styrax, Amber, and the like, it draws forth excellent Tinctures: It dissolves the fixed Salts of Herbs, also of Pearls and Coral, before prepared

pared with Vinegar, by a long digestion, and receives their Tinctures into it self: it leaves Sugar, and Gums, being dissolvable in water, almost untouch'd. But there is another Spirituous *Menstruum*, that is sharpened with a volatile Salt, such is the Liquor which is distilled out of blood, Harts-horn or Soot; it is far stronger than the former, and cuts most Bodies, except Metals, into parts, and oftentimes destroys the forms of the whole mixture: yea it most excellently dissolves secondarily, the most fixed Metal, to wit, Gold, being first reduced into a Calx, by its proper *Menstruum*, and reduces it into a Tincture, or potable Liquor.

They are accounted Sulphureous *Menstrua*, which are brought forth of Sulphureous Bodies, under the form of an Oyl: these are prepared, either by distillation, such as are chiefly the Oyl of Turpentine, Juniper, and the like; or by expression, such as are wrung forth of Olives, Almonds, and other Fruits, or Seeds of Vegetables. Things distilled are of more efficacy, than preparations by expression; either of them draw forth some Particles, from Vegetables, or Animals; by the virtues of which, these Oyls being impregnated, they are made fit for Medicinal use. Yea they are conveniently enough made use of, for the extracting of the Sulphureous Particles of Minerals, which sometimes they draw forth sincere or unmixed: But if Oyl of Turpentine, or Lin-seed Oyl, draws forth by dissolving, the combustible part of common Sulphur, in the mean time, the remaining Saline parts, and untouched by the *Menstruum*, grow into Crystals; as is obvious to every one, in the preparing the Balsam of Sulphur.

Mineral Bodies, in which the bond of Concretion chiefly depends upon Sulphur, as are the Fire-Stone, Antimony, common Brimstone, and the like, are in some sort dissolved by a Sulphureous *Menstruum*, which draws forth of the Body, Particles of the same kind, the Saline being almost untouched: wherefore Oyl of Turpentine, Lin-seed, &c. draw forth a Tincture from these; in the mean time, Saline *Menstrua* such as are distilled Vinegar, or Stygian waters, profit little for the dissolving their Bodies: but that these, unless before Calcined, hardly are touched. But on the contrary, where the frame of the mixture consists of a Saline bond, such as are Iron, Copper and the like, Saline *Menstrua*, as *Aqua fortis*, Spirit of Vitriol, Salt, &c. receive in the dissolving, the Particles of the same Nature into themselves, the Sulphureous being almost untouched. This plainly appears, in the solutions of Metals, but chiefly and remarkably in Camphire, which Stygian waters reduce into a Liquor, in form of an Oyl, swimming on the *Menstruum*; to wit, they dissolve its frame, and receive some Saline parts, on which the Concretion depends, into themselves; in the mean time the Sulphureous being untouched, they are gathered together apart, on the Superficies of the Liquor. There is something to be wondered at concerning Antimony: to wit, that its Concretion being very irregular, that Mineral becomes exceeding unlike, not only to other mixtures, but also to it self; for it is very lax, nevertheless much compacted; it lies open to the least injuries, yet is almost impervious to the greatest, so that it may equally number its losses, with its Victories: some of its Particles lie so loose, that they are brought away by any Oily *Menstruum*, or by a common *lixivium* or Lie: others in the mean while do so pertinaciously stick together, that *Aqua Fortis* cannot touch them, only *Aqua Regia* being poured upon it can know it; which so strongly resists it, that the fume raised up from thence, presently obscures the whole Room, wherefore there seem to be in this, parts wholly of a different Nature, some imperfectly mixt, viz. Earthy and Sulphureous, which are easily loosened by a fit solvent; in the mean time others wholly Metallic, perfectly mixt, coming near in some sort to the Nature of Gold it self; which therefore are only to be dissolved, by a fit *Menstruum* of Salt.

The Saline *Menstrua* are of divers kinds and natures, viz. of Vegetables, Animals, or Minerals. Among Vegetables are eminent, the sour juices of Fruits and Herbs, Counterfeit Vinegars, acid Liquors distilled out of ponderous Woods, as Guaiacum, the Oak, and Box; in all which, the Saline Particles having gotten a Flux, either by Art or by Nature, give a notable sourness: or the Vegetable *Menstruum* consists of Salts of Tartar, or made by the cineration of Herbs, and dissolved, which by the Fire are very much whetted, and acquire an acritude; in these the Saline Particles are fixed, and in a condition opposite to a Flux. To the rank of Animals I refer the Spirit of Urine, Harts-Horn, &c. which although they are impregnated with Spirits, yet they take their chief forces from a Volatile Salt. But the strongest Saline *Menstrua*, are drawn forth of Minerals, such are acetous Liquors, which are most strongly forced

forced by fire, out of the Salts of Nitre, Sea-Salt, Alumn, Chalcarth or Vitriol, and such like.

Those which are drawn out of Vegetables, as Vinegars, and acid Liquors do best of all dissolve Corals, Pearls, Shells, and Shelly substances: because in these there is great plenty of Alcalizat Salt, with which the fluid Salt, which abounds in those kind of acetous *Menstrua's*, desires to be most strictly united; wherefore they being applyed to the body to be dissolved, enter its pores and passages, loosen the Complications of the Particles of the Alcalizat Salt, and snatch them into their own Embrace. Even after the same manner, the fluid Salt in a Vegetable *Menstruum*, approaches the Volatile Salt in the Horns of Animals.

These kind of *Menstrua's* do corrode some Mettals towards the Superficies; but do not so potently unlock their bodies by dissolving, as Stygian waters, some Sulphureous subjects, being before loosened by Calcination, do enter aptly enough, and from thence carry forth Saline Particles. Wherefore, for the Salt of Tinn, Lead, Antimony, Soot, and others, being first reduced into a *Calx*, we use distilled Vinegar.

The Salts of Tartar, and the fixed Salts of Herbs, although they serve for præcipation, rather than dissolution, yet because they consist of sharp, and very penetrating Particles, they are of egregious use: For watry *Menstrua's* are chiefly sharpened with these, for the extracting of the Tinctures of Vegetables. And altho bodies which abound with an alcalizat Salt, as Pearls, Coralls, &c. are left wholly untouched by reason of the Homogeneity or agreeableness of the parts in either; and that also, they but little gnaw, only on the Superficies, being put upon Mettals, and grow together with their Salt, and Sulphur into rust; yet Sulphureous bodies they readily enter, so they be loosened by the fire, and unlock and pull assunder their joyntings or complexions; wherefore, for the making of the Milk or *Magisterium* of Sulphur, the Salt of Tartar most excellently conduces.

Saline *Menstrua's* are most strong, which are forced by distillation out of Minerals, to wit, out of Vitriol, Niter, Sea Salt, Alumn, Arsenick; Acetous Liquors are distilled either from these single, or from many of them mixed together; which as they are of the highest sharpness, like to fire, readily enter most bodies, but chiefly Metallic bodies, and such as consist of a Saline bond, and dissolve them easily into most small parts. These Liquors are only Saline Particles, which being driven by the force of heat, from the embrace of their Earth, having gotten by that means a Flux, are converted into water: as actual fire chiefly assaults Sulphureous bodies, and by destroying the body draws to it self the Consimilary parts; Stygian waters (which are also called potential fire) easily pull assunder bodies, which very much abound with Salt, as Mettals; and break them, inviolable by fire, into most minute parts.

Concerning the Solutions of Minerals, we may observe, that their frame is not easily destroyed, or loosened into parts, as other Concretes of Nature; but for this, most strong *Menstrua's*, and those chiefly Acetous, distilled from Salts, are required; the reason of which is, for that the Concretion of Minerals, depends mostly upon great plenty of Salt, binding the rest of the Particles, as with a bond; wherefore their substance is more solid, more hard, and compact, and only gives place to a Saline *Menstruum*. When any Mineral, or Mettal is dissolved, the fluid Particles of the Salt, in the *Menstruum*, most easily enter the most strict Complications, of the fixed Salt in the mixture, and impervious to any other solvent, loosen them from their binding, and snatch them into their Embraces: after this manner, the Particles of the Salts being united, and dilated by the Liquor, are hidden in the pores and passages of the *Menstruum*; and together with these, stick, and are also supped up, by the *Menstruum*, the more pure and minutely divided bodies of Earth or Sulphur, which were in the mixture; in the mean time, the more thick, and more stuffed with Earthiness, are præcipated to the bottom of the dissolving Liquor: wherefore Gold and Silver are wholly devoured by the *Menstruum*; but Iron, Lead, &c. and also Metallick recrements, send forth from themselves, in the dissolving, Heterogeneous Particles, as so many offscourings: when Minerals are broke into parts by this means, the divided Particles, and most minutely broken, (so long as they equally cohere with the Part of the fluid Salt, which are in the *Menstruum*) being dispersed through the Liquor of the *Menstruum*, and hidden in its pores and passages, are supped up, and rendred invisible. Yea also, the humor of the *Menstruum* being taken away, the remaining

Calx, which consists of the Particles of a mixt, and fluid Salt, combined together, is dissolved in any other Liquor: but if after a Metallic solution, the fluid Salt be drawn off, from the Particles of the thing soluted, or by Calcination, it neither poysses any Liquor it is put to, with a new adjection of fixed Salt, nor do the little bodies of the thing soluted fall through the pores of the *Menstruum*, nor are they lastly supped up, by any Liquor added to them.

But that among Metals, some are corraded by any acetous Liquor; in the meantime others, as Silver and Gold, require a peculiar solvent, as it were to be unlocked by an appropriat Key: and what is more wonderful, common *Aqua fortis*, which eats Silver, leaves Gold altogether untouch'd: then the same Liquor by an addition of *Sal Armoniac*, is made a proper dissolvent of Gold, and has no power upon Silver: The reason of those may be thus understood: Gold and Silver are more compact Metals, very much cleansed from earthy matter; wherefore they are not broken into parts by any solvent, but only by those kind of *Menstruas*, which consist of a Salt homogeneous or agreeable with them. But as the frame or substance of Silver depends upon a Vitriolic Salt, and that of Gold, on an Armoniac Salt (or of a more perfect kind, to wit, such as is wont to be most strictly complicated with Sulphur) hence *Aqua fortis*, so long as it is strong with a Vitriolic Virtue, combines with the Salt of the Silver, and therefore unlocks its frame or substance, but doth not loosen the concretion of Gold, which depends upon an Heterogeneous bond: If that to this *Menstruum*, *Sal Armoniac* be added, the power of the Vitriolic Salt is blotted forth, and the Saline darts of the solvent are made fit only for the Gold, the Silver being untouched.

When Minerals are corroded by acetous *Menstrua's*, we are not therefore to think, the same always to be resolved into Elementary parts: that the Salt and Sulphur of them, may be had sincere or unmixt, by this means (altho some boast, that they are easily able to shew such Analyses of Mettals) for that it appears to our observation, and frequent experience, that many of these are of so compact and solid a Concretion, that they cannot be broken, but into integral parts: as for example, Gold and Quicksilver, after what manner almost soever handled, when they are reduced into manifold Calxes, will at last by a strong fire acquire their proper forms: viz. the Saline Particles of the *Menstruum*, loosen the bond of Concretion, whereby the most minute integral parts of the mixture stick one to another; but the same solvent, is not able in all things, to break assunder the *Copula* of the first mixture, whereby the Elements are mutually bound together: so that for the most part Metallic Calxes, are only little bodies of the Concrete, broken into most small little Globes, being involved by the Saline Particles of the *Menstruum*: Wherefore, fire being applyed, those corrosive Salts being pulled away from their Embrace, are wholly driven away; then the Metallic little bits, or dust, as so many little particular Globes being fused, by the intense heat, coming together into one Mass by melting, resume the Species of the Metall: wherefore, they who commonly affirm, that the Salts of Minerals for the most part, are only the Saline Particles of the solvent, conjoyned with the Metall, reduced as it were into fine flower, without doubt speak truth in the preparations of Sol and Mercury, or of Gold and Quicksilver; also the Salt or Sugar of Saturn or Lead, is nothing else: But that sweetness comes only from the Vinegar; for if in the distillation of Vinegar, the joynings of the Vessels are closed with Clay, and Salt, Chaulk and Horse-Dung, on the Superficies of this, grows together a most white Salt, wonderfully sweet, in every thing like to that Sugar: but from some, viz. from Iron, Copper, and Silver, are prepared fictitious Vitriols, which are for the most part Saline: For that the same, by distillation, may be forced into acetous Liquors, as the Metallic recrements.

Besides the solvence hitherto recited (which, by means of the Particles, which are strong in them, act upon a peculiar and determinate matter) I know that Chymists do boast wonderful things, of a certain universal *Menstruum*, by whose inspiration every body what ever, may be easily reduced to its Principles, or first Elements: And tho *Helmont* have bragged, that he had attained to this Secret by his own Labour, and now dayly the Adepti of Chymistry, do aspire to this end; yet the hopes and endeavours of most, have failed them in this work, even as in the Philosophers Stone. There are also some other famous *Menstrua's*, viz. The *Aqua vite* Tartarified of *Quercitan*, and his Philosophic Vinegar, which are of noted use in the preparing of Medicines; but since I know nothing, or any strange thing they have done, in the dissolution of Bodies, we will pass them over.

So much concerning solvent *Menstrua*: about bodies to be dissolved, a certain provision should be instituted, whereby indeed their complections may more easily be unlocked, and cut into most minute parts; Wherefore the Concrete is now pounded into powder, now cut into little bits, that the way might lye open for the solvent, to its most inward recesses. If that the frame of the Subject be harder, and more strict, that it will not give place, but of a long time, to the *Menstruum*, before the dissolution is begun, there ought to be administred some aperitives, or openers, whereby the concretion may be first loosened, and somewhat opened: wherefore, the tincture of Steel, is more easily extracted, if its filings be sprinkled with the juice of Limons, or the Spirit of Vitriol: in like manner Harts-Horn, or the shavings of Ivory are handled when we would have the decoctions of them quickly made: when formerly I have been very solicitous about this thing, viz. that I might render the more hard bodies easily soluble, in any *Menstruum*, and that I had especially tryed many things about Iron; after several experiments, at length by a certain chance, and almost thinking of something else, I found out a preparation, whereby without any Corrosive, or Acid Liquor, by the mediation only of a gentle heat, the body of Iron is opened, that being reduced into powder, gives immediately a tincture, to any Liquor, that neither Salts themselves, are sooner dissolved in common water: By this means, I am wont to prepare suddenly, in great quantity, Mineral waters, which exactly resemble our *Tunbridg* Spaws; and to render Wine, Beer, Milk, or Whey, with no trouble Chalybeated. By this means, Syrrops, Tinctures, Extracts, or *Magisteria* out of Steel, are most easily to be had. Moreover, plainly by the same Artifice, Corals, Pearls, Eyes, and Claws of Crabs, and all shelly things, are prepared, that their powders presently impart to any *Menstruum*, a tincture, or the virtues of the whole Concrete. And in this preparation, no strange quality is introduced to the Subject, nor its own proper quality lost.

When I had by this means, learnt to unlock all Bodies whatsoever, consisting of a Saline bond, presently from the Analogy of this, was made known the means of unlocking Subjects, whose Concretion is wholly Sulphureous: for I am wont so to prepare common Sulphur, that its powder immediatly impregnates any Liquor, with the tincture and virtue of Sulphur. The Spirit of Wine, suddenly contracts a deep colour, and very red, that being put into it. Common water by the infusion, or decoction of the same Powder, is rendered clearly Sulphureous, and gilds Silver, and by this means, from that Tincture, a præcipation being made of White Wine, or Vinegar, the Milk of Sulphur is easily prepared, in great quantity. Out of Sulphurated Wine by this infusion, I make a Syropp, than which there is scarce found a more excellent remedy, in the distempers of the Thorax. By this means, Tinctures, Extracts, Magistries, are prepared from Sulphur, with no labour, and without any smatch of the fire. By the same way preparations from Amber, Benzoin, and other Sulphureous things, easily dissolvable in any *Menstruum*, are composed. But enough and too much of this: we will now pass to the other great dissolvent of Nature.

C H A P. X.

Of the Nature of Fire: and by the way of Heat, and Light.

WE may almost pronounce the same thing of Fire, what the Philosophers of old did of the first Matter, to wit, that it was potentially every where, and in all things; but in none, in act. For among these sublunaries, Fire hath got no existence of its own Nature, or certain means of duration: It is produced almost in every Subject, but is retained long in none, but it suddenly vanisheth, and expires: yea unless some external accidents, oftentimes should concur for its production, I think it had not at all been in the world. Some have dreamed, that its Sphear is scituate under the Moon: but this was introduced only, for the making the Hypothesis of the four Elements: for such a thing seems consonant neither to Sense, nor Reason. That we may rightly search out the Nature of Fire, we must seek in what Bodies it is chiefly to be found, and how they are disposed; and then we may proceed to the unfolding its essence.

The Subjects most convenient both for the producing, and the maintaining of Fire, are of that kind, in which there are very many Particles of Sulphur, and but only a moderate portion of Water, Salt, and Earth: for these do hinder its inkindlings, and being plentifully poured on it, extinguish it being inkindled: Wherefore Bituminous, Fat, and Oyly things, quickly take flame: so also Chips, Straw, light and dry Wood: in the mean time, Metals, Minerals, the glebe of the Earth, Dung, wet Straw, and green Wood, are hardly, or not at all to be inkindled.

Secondly, we observe, that all the time Fire continues in the Subject, Sulphureous Particles fly away in heaps, and from the departure of these, the substance of the burning body is by degrees destroyed; in the mean time, very much of Salt and Earth, remains in the form of Ashes, after the burning.

There is a third observation, that when the Sulphureous Particles are wholly, or for the most part flown out of any Subject, the burning wholly ceases, and the form of fire is quite destroyed; nor can it be renewed in the remaining matter, wanting of Sulphur.

Fourthly, we will note, that sometimes some Bodies conceive a burning without the advention of another fire, only by their own effervency, and by the intestine motion of the implanted Particles, and of their own accord are reduced into Ashes; as when wet Hay is layd up close, it first grows hot, then afterwards breaks forth into smoke and flame; or the Wheels and Axeltrees of Carts or Wains, being heated by too great agitation, are inkindled.

According to these positions, we may affirm, that the form of fire, wholly depends upon Sulphureous Particles, heaped up in any Subject, and breaking forth from it in heaps: and that fire is no other thing, than the motion and eruption, of these kind of Particles, impetuously stirred up. For Sulphur is of an exceeding fierce and untamed Nature, whose little bodies, when (the yolk of the mixture being shook off) they begin to be thickly heaped together, diffuse themselves on every side like a torrent, break whatsoever obstacles are in the Subject, destroy whatever comes in opposition, or sling it down headlong. Nor do they only unlock their proper Subjects, but also lay open the gates and doors of any other Subject near, that they can reach to, and there incite to the like fury, all the consimilary Particles of Sulphur, and provoke them to an eruption: wherefore fire every where inkindles fire.

The Sulphureous Particles, while they, heaped together within the confines of their Subject, or on its Superficies, are agitated with a rapid motion, but are detained by the Embrace of other little Bodies, from a more free eruption, and more aggregated, constitute the form of fire; as is to be seen in burning Coals, or in glowing Iron; but when these sort of Particles fly away by heaps, from the same Subject, and bound together, they produce flame, which is only an heap, or rather a torrent, of the Particles of Sulphur flowing together, and conjunctly flying away: if Watery, Earthy, and

and Saline Particles, are commixt with the Sulphureous breaking away, and are able to disjoyn and separate them, only smoke is excited; which afterwards, the Sulphureous little Bodies more plentifully breathing forth themselves, and getting together, breaks forth into flame.

The inkindling of Fire happens very many ways. The first and most simple is, when from hard bodies struck one against another, but ofteneft from a Flint struck against Steel, sparks of fire break forth; which being received in Tinder, made of a Linnen Cloth burnt to blackness, dilate themselves, and then a Match or Sulphurated thing being applyed, they cause the inkindling of a flame. Secondly, a fire often happens in dry Wood, and dry things, when by the too great attrition of the parts, and agitation, being made hot, they conceive an inkindling of their own accord. And thirdly, when Bodies abounding with Sulphur, as Hay, or Flax laid up wet, (of which mention was before made) grow hot of their own accord, and afterwards are inkindled. The fourth way, is the most usual, of introducing fire into any Subject, that it may be inkindled by another fire. We will a little more consider the several processes of these.

1. Hard Bodies struck one against another, shake forth little sparks of fire: as a Flint with Iron, or with a Flint; *Indian Canes*, the Fire Stone, and many other things. The reason of this is, because the Particles of Sulphur, which reside in the Superficies of a hard Body, if they are smitten by another hard Body, are not able to go back inward, (because in hard things there is not afforded any cession of the parts, from place to place) nor can the smitten Particles of Sulphur evaporate by degrees; but that by reason of the vehemency of the stroke, they are necessitated to break forth in heaps: Wherefore, when by this means, many of them are moved together, and are aggregated, they exhibit the apparition of fire. The sparks being received into the half-burnt Linnen or Tinder, are dilated into a greater fire, for that the Sulphureous Particles, in such a Subject are eminent, and are brought as it were to the very top it self of eruption or breaking forth, wherefore by the least spark being moved or stirred up, a way being made they fly away.

The very same reason is for Wood being made hot, and afterwards fired, by too great attrition; by which means, the Axeltrees and Wheels of Chariots, or of Mills, are frequently fired: for the Sulphureous Particles, being by this means very much moved, are more thickly heaped together; and when, having as it were made an Army, they are able to remove, or strike away the rest, they presently break forth in Troops, and by their going away cause a burning.

In Hay or Dung laid up wet, the Particles of Sulphur very much abound; which having gotten the watery Latex for a Vehicle, run themselves into motion: but when for want of Ventilation, they cannot by little and little exhale, being straitned within, and so brought into their exaltation, they are able to joyn more one to another, and mutually to incite themselves: then afterwards, being very much heaped together, they unfold themselves more largely, and begin to break the Dens of the Subject, and so produce a burning. For it is to be observed in any Subject, when the Particles of Sulphur, being more slowly moved, fly away by degrees, neither heat, nor fire, but only a dryness, and leanness, succeed. But if they are more rapidly moved, than that they may be able to exhale leisurely, a heat is stirred up in the Subject: then if yet they are agitated more vehemently, and impetuously, and being more thickly agglomerated or heaped together, they break forth in heaps, a deflagration or flame follows the heat.

Fire being inkindled in any Subject, enters and inkindles, whatever Sulphureous thing is next it. For as Saline *Menstrua*, viz. Stygian waters, assault Metals, stuffed with Mineral Salt, and loosen their Saline Particles, as being of kin, from the mixture; so also the Sulphureous Particles, being inkindled, break whatever Sulphureous Particles are next them, and stir them up into the like motion of burning, with themselves.

Thus much concerning the nature and production of Fire: it remains that we next inquire into the effects of Fire, and also concerning its virtue and efficacy; to wit, what kind of Bodies it dissolves, and by what means; and also for what uses it serves for. The chief effects of Fire are Heat and Light; either of them are excited by emanations, or *Effluvia*, sent from an inkindled Body; but after a far different manner: for truly, heat is most often produced at a distance, without light; also light, without any sensible heat.

Heat;

Heat, forasmuch as it belongs to the sense of the touch, is conceived, when a certain passion is induced in the skin, or any other Organ of the touch, whereby the little Fibres and Nervous parts are drawn asunder, moved into light Spasms or Convulsions, and sometimes (if the stroke be vehement) suffer a solution of the union. This is wont to be done, either by the bringing near of Fire, or of another Body made hot by Fire, or by some other means. For from either, the Sulphureous or warming Particles being excited, into a more rapid motion, and breaking forth by heaps spread abroad, which, as so many little darts, being thrust into our skin, or other Sensory of the touch, either by tickling gently, they bring to it a pleasing sense of heat; or by striking it more grievously, the troublesome sense of burning or scorching.

For the effect of heat, Fire is applyed to Bodies, either immediatly, and so either for the sake of Burning, Roasting or Boiling; or mediately, *viz.* by the interjection of another Body. Bituminous things, Coals, and other things dug out of the Earth, also Vegetables and chiefly their Leaves, and Woods, are burnt, for heat, necessary for human uses, and for the producing, and conserving it. Stones are burnt for Lime; Vegetables for the preparing of Salts. The flesh of Animals is wont to be Roasted, and the Fruits of Vegetables; whereby they may become better food for men. For by Roasting, the superfluous humidity is evaporated, and the Sulphureous parts being stirred by the neighbouring heat, are placed in their vigor and exaltation, by which means, they afford a more grateful food to the Palat, and of better digestion to the Stomach. By fire Metals are fused or melted, and most Minerals, whereby they are either very much purified, or they are better formed into various figures by Smiths. Metals, and very many Minerals, also Salts, although they are not inflamed, and take a firing (because they abound with less Sulphur, than Salt) yet by a violent fire, they glow, and suffer a fusion; for that the Sulphureous Particles of the Fire, enter the Saline little Bodies, tho most compact, and dissociate them for the time; which however pulled one from another, presently the fire being exhaled, come again together, and are strictly united.

Secondly, when fire is mediately administered, the Particles of the soluted Sulphur, and heaped together into fire, are dissociated, as when a cloud is dispersed into most little drops of Rain: wherefore they lay aside the form of fire; but tho dispersed, they easily pass through any impediment, and induce a sufficient strong heat to every Subject. By this means, fire is accommodated to very many uses, the chief of which, and the more accustomed, are, elixation or boiling, digestion, and distillation.

In Boiling, the Particles of heat do pass into a watery *Menstruum*, and being united with its Particles, insinuate themselves deeply into the thing to be boiled: whose superfluous humidities they carry away, digest the crudities, and carry them into a state of maturity. Boiling is instituted, either that the Liquor might be impregnated with the strength of the thing to be Boiled, or that the thing to be Boiled might be made tender, by the Liquor entering into it, and its Particles exalted: for Meats and all Eatable things, are rendered more grateful to the Palate by Boiling, even as well as by Roasting.

Digestion is very much used in Medicines, that their more slow Particles, may be carried to a greater activity; and sometimes, that they being too fierce might be fixed, and rendered more mild.

The most noble use of heat, or of mediat fire, is had in distillations; for the Particles of heat, do pull away some Particles of the Subject from others, (as it were by a Spagyric Anatomy) they resolve all Bodies, into their parts and principles. But the consideration of this thing, is too laborious and hard, to be inserted into this Tract.

As heat respects the Sensory of the Touch, so Light that of the Sight, and affects it so after a proper and peculiar manner, that nothing at all is discerned, besides the rays of light, direct, or reflected: for the various appearances of Colours, and the divers proportions of Bodies, and whatsoever we see with our Eyes, is only light; to wit, either proceeding directly, or strait from a lucid Body, or retorted from another Body, to the Eye, and so formed into various figures and colours. The consideration of Light, contains in it self, very many stupendious things, and is of deep speculation; which are not however proper for this place: It will suffice to take notice here, of a few things, concerning its Original, Motion, and Perceptibility.

Light

Light is wont to be distinguished, either that it is *Ethereal*, which flows from the Sun and Stars; or *Elementary*, which only proceeds from a fired Body, enkindled into a flame. It seems, that either is only flame enkindled in a greater dimension, and dilated into a most thin composition: for it appears to the sense, that from *Sulphureous* things being inflamed, (as for example) from a burning Candle, most thin *Effluvia's*, or most small divided little Bodies perpetually do spring; which being diffused into an Orb, and stretched forth into right Lines, as it were from the Centre to the Circumference, are still expanded on every side, in a great heap, and fill all the space within the Sphere of its activity, with a luminous ray. The Particles of the flame, which first fall away or depart from a lucid Body, are still driven forward by those following behind; and so these also by others; and so by a continued Series of Particles of the flames still succeeding, the beams of light are formed, and are thickly or closely directed into all parts.

The motion of these is exceeding swift; like streams of water, breaking forth with a force, they pass through the medium in the twinkling of an Eye, and, as those waters, if the motion be cut off near the Spring, most swiftly vanish. When the Rays of light come directly from a Luminous Body, they constitute a medium, only clear or lucid, without the appearance of any colour or image: when the same Rays meet with a solid Body, they do not pass rightly through it, but being either broken off, they are drowned or lost, or else they are reflected and leap back or rebound, as when a Ball being cast against a Wall, with a continued motion is struck back, upon other parts, according to the Angles of what stopped it. The Rays of light, reflected from other Bodies, being fallen into the Eye, represent the Images of visible things, and the varieties of colours. For as the superficies of visible Bodies are rough, and indued with little pores, and innumerable eminences, or risings up, hence the Rays of light, being most thickly impacted in them, and reflected from every part, according to all the ways of inclinations, and directions, as far as they go, do meet together round about, into very many tops of Cones, in which the beams proceeding from the whole object, as from a base, represent the image or similitude of the whole; and in these kind of images, the medium is every where planted, that wherever the Eye is placed, it beholds the image of the same thing, though not wholly after the same manner. But forasmuch, as the beams of the same light, being impacted in every Body, and variously refracted and distorted, about its rough and unequal superficies, from thence reflected as it were with turnings and windings into the Eye, they cause the diverse Phenomena or appearances of colours, to appear. For colours, and images of things, do not exist in their own nature, but as it were spectrums, only from another place, change their apparitions by the Rays of light. When dark night brings thick darkness to this inferior world, things are not perceived but by the Touch, and lose all their appearances: when the Sun revisits the Hemisphere, he brings forth a new Creation of things; and the whole Atmosphere is filled at once, with a sudden and manifold progeny, to wit, with infinite images of Bodies, and appearances of colours.

Therefore Light does not only illustrate the medium, that sight may be made, as some would have it; but it also creates the very objects of sight, and introduces them into the Penetralia or inward parts of the Eye, yea to the most inward recesses of the Brain. This doth the same Office for the Eye, as the Intellect doth for the Soul, to wit, it forms the Ideas or Images of Bodies, and renders them perceptible by the vivifying faculty. Light only is able to penetrate the Coats and Humors of the Eye, to move the little Fibres of the Optic Nerve, and to stir them up into an act of sensation. Because the Images of things, being forged by the Rays of light, variously reflected, and meeting together on the tops of the Cones, are stayed within the Pupil, or dark spot of the Eye; they seem as objects in a close Chamber, admitted by a small hole, to be represented to the life: and the Concave or Convex Glasses, whereby the parallel beams are broken, or the inverse reduced or brought back, do egregiously supply the humors placed in the Eye, beyond the industry of human Art; by the help of which, the image of every object is painted, near the thin skin of the Eye, in its just figure and proportion: and then, from the motion, which this Image impresses on the little Fibres of the Optick Nerve, the act of sight is performed in the Brain. Thus much for Heat and Light, the Speculation of which, tho it may seem to be altogether besides the Doctrine of Fermentation, yet forasmuch as by the motion of these kind of Sulphureous Particles, many other Physical Operations are also performed, a

brief

brief mention of them ought not to have been overpass'd in this place. But before we shall lay aside quite the consideration of Fire, it will be here worth our while to inquire concerning some Subjects, as it were irregular, to wit, in which fire shews admirable virtues, and beyond its common manner: of this sort, are among Simples common Sulphur, and *Sal Nitre*; among Compounds, Gun-Powder, and *Aurum Fulminans*.

Concerning common Sulphur we may observe, that it quickly catches fire, heat it immediatly breaks forth into flame such (as nothing besides) that by its deflagration it puts out the Kitchen fire, that it sends forth a blueish flame, and whitens all objects with its Smoke or Soot. If you behold the matter of this Subject, or the parts of which the mixture is composed, its Spagyricall Analysis will exhibit, great plenty of pure Sulphur, a moderate quantity of Vitriolic Salt, a little of Spirit, Water and Earth. For when common Sulphur is dissolved, by the Spirit of Turpentine, the Sulphureous part impregnates the *Menstruum*, with a very deep Tincture, and the Saline grows into Crystals: or when it is fired under a Bell, the Sulphur wholly burns, in the mean time the Salt being resolved, and having taken a Flux, is fixed about the sides of the Vessel, and so exhibits a Liquor, most like the Spirit of Vitriol, or rather the very same. To which add, if you mingle the Oyl of Vitriol, and Antimony together, and distill it in a Retort, a Yellow Sulphur, just like the common, will be Sublimed in the neck of the Retort.

I say therefore, because there are very many Particles of Sulphur in this Concrete, and that they lie loose and unbound in the mixture, (to wit, neither divided and separated by the coming between of Earth, or Water, nor much bound together by Salt) therefore they are of a most prompt motion: wherefore by the least spark of fire, they break forth from the loose frame; and because very many run forth adooors together, therefore not a naked fire, as in every Combustible thing besides, but first of all and immediatly a flame is inkindled. Its flame becomes blueish, because 'tis almost pure Sulphur that burns, not mixed with the Particles of Water and Earth, as it is in Wood or Straw. The very same thing happens to Spirit of Wine being inflamed. It extinguishes the Kitchen fire by reason of the little Bodies of Vitriolic Salt left behind; and the same being eventilated with the flame and fume of Sulphur, gives a white colour to things; the like to which, the *Effluvia's*, exhaled from the Spirit of Vitriol, or Stygian Waters, do effect.

Concerning *Sal Nitre*, we will take notice, that it is not to be inkindled at all by it self; but to be melted by an intense fire: but being mixed with any Sulphureous things, it breaks forth into a flame, with a certain force and explosion: For being added to common Sulphur, Antimony, or Tartar, it burns with a thundering noise; also if you put into melted Nitre, a burning Cole, or Wood, the flame is exploded round about, with a wind, so that the matter put in is flung up and down here and there, and often times flung clear out of the Vessel: by this kind of deflagration, what is Nitrous is consumed, the fixed Salt (which is Tartar) remains. When Nitre is distilled, Sand or Brick dust, is mixt with it in a double quantity at least; otherwise the Nitre melting is not at all loosened into a vapor. In the distilling the vapor sent forth is very red; so that the Receptacle shines with a splendor, as if a flame were shut up within it: a sharp corrosive Liquor is stilled forth, which dissolves most Metals; also Gold.

These things being truly weighed, it seems that this mixture consists chiefly of abundance of Salt, and a little Sulphur, but these not fixed and idle, but either exalted, and ready for motion, and not without a certain resistance bound together: to wit, the Sulphureous little Bodies, being rouled about by the Saline, and as it were strictly pressed, still endeavour to get forth; but being strictly bound within, they are not able to rise forth by their own strength, or endeavour: but as soon as, by the mixture and inkindling of another Sulphureous Body, the Particles of the Salt are disjoyned, and their Prisons unlocked, presently the included little Bodies of Sulphur, as it were breaking Prison, fling themselves forth with violence, remove every Obstacle, and strike the Air violently with a sudden eruption.

The reason why fire doth not inkindle Nitre, being inclosed in a Vessel, but only melts it, when in the mean time, any Sulphureous matter being fired, makes it to flame forth with a noise, is, because the little Bodies, which fall away from the fire, enter the Nitre, make it a little loose, and dissociate the concretion of the Salt, but not so loosen it, that a way may be made for the included Sulphur: but by the addition
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of Sulphureous things, the Saline compaction is more dissolved, and is so far unlocked, that the Particles of the inclosed Sulphur fly away all together, and being freed from their straightness, do hugely stretch themselves abroad, and seek greedily an immense space.

That there is plenty of Sulphur in Nitre, besides its deflagration, the Genesis of it sufficiently testifies; for it is begot chiefly in places, where the Sulphureous Excrements of Animals abound. The use of it in agriculture argues the same thing, because the fertility of the Earth depends very much upon it: And to this also, the flaming colour, shining in the distilling may persuade.

From these premises, it will not be difficult, to unfold the nature of Gun-Powder, used in Warlike Instruments. For the sudden firing, and vehement explosion of it arise, for that those very many, and almost infinite Particles of Sulphur, which constitute that fire-dilating Body, being fired, fly away together in a moment; all which breaking forth at once, a force being made, and desiring a most free and ample space, for their expansion, violently move the Air, and all obstacles, and so are exploded or thrust forth with a noise. There is in this mixture, common Sulphur put, because its Particles are loose, and ready for motion, and therefore apt to move a quick inkindling: there is added Charcoal dust, because in that also, the little Sulphureous Bodies (as is seen in Tinder, that is made of half burnt Linnen) are brought to the very top of eruption; and therefore these presently conceive an inkindling, and both these being fired, and opposed to the Nitre, they quickly loosen its frame, and send forth the Sulphureous Particles inclosed in it; which indeed break forth from their impediments with a force, and as the blast of a Bellows, encrease the strength of the whole in firing. The Charcoal dust is added in a moderate quantity; though it abounds with Terrestrial matter, yet by reason of the Sulphur being carried forth in it, it accelerates the deflagration of this mixture: For the Coal and Nitre being beaten together, is sooner fired, and with a greater explosion, than Nitre and Sulphur: But if the Coals be added to this Composition, (as they are wont to make it for Cannon and great Guns) in a greater quantity than it ought, and impropportionate to the Nitre, the immediat firing is somewhat retarded, by reason of the interjection of the Earthy matter; and it happens, that the Sulphureous little Bodies therein, apt to be too hastily inkindled, are a little disjoyned, and so the substance of the infused powder, takes fire successively, and by parts, and not all at once.

The reason of *Aurum Fulminans* does not so manifestly appear: but it seems wonderful, that the Calx of a Metal, otherways inviolable by fire, should be brought into a powder, one grane of which, if it be but lightly heated by fire, is exploded with so great a force, and yields such a noise, that is an hundred fold beyond Gun-powder. I know many deduce the cause of this, as in Gun-powder, from a Nitrous-Sulphureous mixture: For they suppose the Nitre drawn forth from the solvent *Menstruum*, to joyn together with the Sulphur of the Metal, and so the powder from thence prepared, to get that fulminating force. But in truth, if this matter be better thought on, it will appear far otherways; because this golden thundering powder, is not at all inkindled, as preparations of Nitre with Sulphur: for if fire be put to it, it goes off only successively, by grains, nor as in Gun-powder, doth the whole fulminate at once; but being put into an Iron, Silver, or other convenient Vessel, and for some time heated, by a sudden fire, at length all the Particles being stirred together into motion, it is exploded with a mighty noise; but yet being exploded, it yields neither flame nor sparks neither is the Gold lost. For if this powder fulminates in an open Vessel; whatsoever is of the Gold, remains after the thundering, in the form of a purple powder; and may be gathered up. That the genuine cause of this may be extricated, there are some things to be observed, concerning its preparations, which will give no small light.

For the making of this powder, it is altogether requisite, that a solution of Gold be made with a *Menstruum*, impregnated with Sal Armoniack, or at least Analogical to it: for I have tryed it in vain with the Spirit of Nitre, Salt, with the Bezoartic Spirit, and some others. Then next it is requisite, that the Calx be precipitated with Oyl of Tartar; for if the same be brought into a powder, with Silver or Mercury being cast in, it loses its thundering force. Also, if the Liquor of the Tartar, be too precipitately poured in, that with the great heat, a repercussion of the thing soluted be made, it often loses its fulminating virtue: but a precipitation being leisurely made, the powder settling in the bottom is washed away, by the often pouring on of warm water, which, though it be most often washed and dried, far exceeds the weight of the dissolved Gold.

According to these positions, it seems most likely, that whilst the Gold is dissolved by an appropriate *Menstruum* for this business, some little Bodies of *Sal Armoniack*, (or some other resembling it) being greatly akin to the Gold, do most strictly cohere with its Particles; which then by the Salt of Tartar leisurely in the precipitating infused, are more fixed, and more strictly tyed fast together: and then the explosion of this powder, or Solary Calx, is nothing else than a violent eruption of those kind of Salts, from the Cohesion or Embrace of the Gold. For when the powder prepared after this manner; is brought to the fire, or is otherways made hot: the heat causes the *Sal-Armoniack* Particles, or others of the same nature affixed to the Solar, to dissociate; which notwithstanding, (when they hardly depart one from another) are not pulled asunder, but by a strong and continued heat: yet afterwards being pulled asunder with a certain force, by reason of the sudden and violent breaking off, they strike the Air impetuously, and so cause a most strong noise, for their bulk. But in the mean time, if the explosion be made under a Silver Spoon, you will see a separation made of either Particles, here the Solar of a Purple colour, there the Saline of an Ash colour. But that this powder doth not make a noise, unless it be leisurely precipitated with the Oyl of Tartar, it is because some Particles of the Salt of Tartar, being before bound together with the *Sal-Armoniack* Particles, do couple together, by which means all are more strongly combined: For the Salt of Tartar being pounded with the mixture of Nitre and Sulphur fixes their Particles for a time; that this Composition is not presently inkindled by heat; but afterwards is exploded with a strong noise. And powder prepared after this manner seems to imitate the Nature of *Aurum Fulminans*: and it is probable that from other Minerals dissolved and precipitated by reason of the strict Cohesions of the Salt with the Metallic matter, and their violent abruptions, thundering Calxes may be prepared. That truly the preparation of this chiefly depends on the Combination of the Salts, it appears, because, if in the Precipitating (as I have known it sometimes to have hapned) the Oyl of Tartar, being too hastily infused, the Complexion of the Salts is dissolved with the Metallic matter, the powder falls in small quantity to the bottom, and of a very Purple colour, whose grains are fragments of almost most pure Gold, and therefore they do not fulminate at all: afterwards in that precipitated Liquor, very many slender Crystals grow together, which are indeed the Salts, having suffered a Divorce from the Metal. Besides, That the Salt of Tartar, brings something to the preparation of this powder, it is a sign, because those things which take away the fulminating force from this, are of the same Nature, which chiefly work upon the Salt of Tartar; as a beating it together with common Sulphur, Spirit of Salt, Oyl of Vitriol, or of Sulphur: for these grow hot, and greedily desire to be joyned with the Salt of Tartar, and so they call it away from the Embraces of the Gold; by which means the Combination of the Salts, with the Particles of the Gold, is loosened, and therefore loses its Gun-like force. What is commonly said, that this powder will be presently inkindled, or exploded, by a most light heat, or by shaking it in an Iron Ladle, is nothing true, as appears to me, for I have often tried it. Nor is it more worthy of belief, what is said, that this only forces downwards, and breaks the thickest hollow Pipes with its force; in the mean time, that it doth not move or shake any thing laid over it, because long since I made tryal after this manner; two grains of this being laid in a Silver Spoon, I covered with a Doller, then a Candle being held under the Spoon, upon the explosion of the powder, there followed a great noise, and there was a little hollow made in the bottom of the Spoon, almost through, and the piece of money was carried up with a force to the Cieling, wherefore, when this *Aurum Fulminans* is exploded, its force is diffused round.

Altho vehement heat, and incited, and also the emission of Smoke and Soot, depends for the most part upon fire; yet sometimes we perceive it to be produced in some subjects, and that in a very high degree, without its being actually inkindled. A most known instance of which thing is, quick Lime sprinkled with water: which also Stygian waters shew, being mingled with Iron, the Butter of Antimony, and with the Salts of the stagma of Vegetables. The learned men, *Gunter*, *Conringius*, *Hogelandus*, and almost all that have touched on the Doctrine of Fermentation, have delivered the effects of this Nature, as especial examples of Fermentations, wherefore it will be worth our labour, to inquire something concerning each of them: but on this condition (which I also have observed in other disquisitions) that I willingly let alone the opinion of others; for a Traveller had rather drink at the Fountains them-

themselves : I will then as briefly and succinctly as I can dispatch the business.

Quick-Lime is made of the Lime Stone, also of many others (excepting only such which consist of a reddish and as it were sandy grain) being Calcined in a close Furnace, for many days, with a reverberating fire : by this means, the frame of the mixture is loosened, that it goes into a friable matter, or that may be crumbled, which by reason of the high astringent or binding Nature, in which it excels, serves most excellently for the making of Cements for Walls : This Calx or Lime being taken from the Furnace, retains still the form of Stone, and seems cold to the touch, but water being poured thereon, it swells up, and grows wonderfully hot, sending forth smoak, that it burns all Bodies that are put into it, besides it falls of it self into a white dust : To which Particles this motion and heat ought to be ascribed, *viz.* whether to those implanted in the Lime stone, or to the others acquired by the fire, doth not easily appear : but that we may loose this knot, if we can, I have instituted this Analysis of quick Lime. I put about half a pound of it into a large Cucurbit, then water being poured thereon, I fitted the little Head with a capacious Receiver, by and by, within five minutes of an hour, the matter began to swell, and to grow very hot ; then a smoak, and a breath being raised, all the Vessels became so hot, that I could scarce touch them with my hands. A clear water Distilled forth into the Receiver, about six Ounces, which was not sharp, but of a Styptic or Astringent sweetish tast ; the remaining powder in the Cucurbit, I boiled with common water, and the Lye thereof made ; I endeavoured to boil away with a gentle Fire ; while it did evaporate, there gathered together on the Superfices of the Liquor, a white and crusty little skin, also of a sweetish tast, and the same being taken away, presently a new one succeeded ; the humor being at last wholly exhaled, there remained in the bottom nothing that was sharp or salt.

We may Collect from this, that this heat doth not proceed from the implanted Principles of the Lime stone, *viz.* either Saline or Sulphureous however moved within themselves : for only a sweetish Salt was to be found in it, which was also Volatile ; and it is a sign that there is not much Sulphur in the Limestone, because by a long Calcination, the form of the mixture is not quite destroyed, nor its substance wholly broken : wherefore, it is very likely, that whilst these stones are burnt in the Furnace, some Particles of Fire do strictly cleave to the Saline, and so reside in that mixture, as it were strangers ; which whilst they lie a sleep, and continue idle, and being separated one from another, by the coming between of Earth, although they are very many, do not raise up heat ; For all heat depends upon motion : but when water is poured to it, those fiery Particles, being thrust out of their Cells, flow together, and fly away by heaps from that Inn ; so breaking forth by Troops, they cause a very intense heat, and because diluted with water, only a smoak, and not an actual Fire.

It is a sign that little Bodies of fire, or fiery Particles, do stick a long while in matters Calcined, because Iron Instruments, according as those Particles are driven forth of their pores, more or less, leisurely or by heaps, become soft or hard ; tough or brittle : moreover it is observed, that bricks or fresh Earthen Vessels being dipped in water, cause a certain hissing ; also Tobacco Pipes, if one end be put into water, and the other brought near to the Ear, yield a certain sharp noise and rumbling : add to these, that fixed Salts being Calcined, or having suffered a Flux by the Fire, become far sharper ; also Stygian waters, by reason of those kind of little Bodies involved therein, which afterwards leisurely evaporate, perpetually send forth sharp fumes : and when these are poured upon Saline Calxes, not only an Ebullition is raised, by reason of the disagreeing Particles of the Salts, which strike one another mutually, whereby they might be more strictly combined ; but besides, heat and smoak succeed, which for the most part arise from the fiery Particles being thuck out of their Dens. But it is not easie to give a reason why quick Lime, and no other Concretes, retain so copiously those kind of fiery Particles, and yield a strong heat, water being poured on them.

Tis plain enough that when the Sulphureous Effluviiums of Fire, (so far as they are most penetrating) enter all Bodies whatsoever, brought near, affect them after divers manners : those which are more lax, and stuffed with active Principles, are destroyed wholly by burning, and because their substance decays, the fiery Particles, as Soldiers in a City spoiled by themselves, do not continue long in the ruined place,

but go farther, and move their Tents: but where the Concretion of the Subject is very compact, and that its Elements cannot be so pulled in pieces by the fire, that they rather grow stiff, as is seen in Metals, Glass, Bricks, and other things made hard, either by boiling, or fusion; the fiery Particles entered in, being received in an incommodious Inn, presently go forth again; and therefore few are wont to stay in mixt things of this kind, or in things fused, or Calcined: but if fire be so applyed to the more hard Concretes, of which sort are most stones, and shelly Concretes, that the bond of the mixture be unlocked, some parts, viz. the Watery and Sulphureous are driven away, and so some spaces are made hollow, very fit for the receiving any stranger; in the mean time, that the frame of the matter be not wholly destroyed, but that it may continue its compacted and stony form, which flows not away together with its Particles, and ever threatens its ruin; in such a Subject, chiefly the Particles of fire, possessing the spaces of the parts flown away, copiously remain; and there cleaving close to the Saline little Bodies, being detained one from another, by the coming between of the earthy, lie quiet; which notwithstanding afterwards, being violently driven from those Inns, are able to produce by their eruption, an intense, and almost fiery heat: in the mean time those Saline little Bodies, are so loosned, by the long familiarity of the fiery, and by the embrace of one another, and of the strangers, that they become Volatile, and being diluted with water, for the greatest part evaporate with it; and the remaining Salt, because also Volatile, and having suffered almost a divorce from all the rest of the Principles, is both sweetish, and becomes desirous of Conjunction, and astringent; and therefore also is of excellent use for plastring of Walls.

But that Stygian waters, being poured upon the Stagmas of fixed Salts, produce heat, and the same mixed with Iron, or the Butter of Antimony, stir up a mighty ardor, with a blackning smoak, the reason seems plain. As to the Stygian waters and fixed Salts, it may be said that both these Concretes are only Salts, having got divers states by the fire, and so either being very much stuffed with fiery Particles (which are the most minute atoms of Sulphur:) But they being confused together, do forthwith rush into mutual embraces, and because the Particles of either, are made unlike, therefore, whereby they may be more strictly united, there is made a great attrition of parts, and together an excussion of the fiery Particles, from whence the great ebullition, with a heat is excited: when the same *Menstrua*, are poured on Iron, or the Ice of Antimony, the Salts of either come together, and shake forth the fiery Particles, and also the Sulphureous Particles, before implanted in either Subject; which flying away in heaps, cause a smoak with a heat, but not a flame.

C H A P. XI.

Of the motion of Fermentation, as it is to be observed, in the Precipitation of Bodies.

WE have hitherto treated of the Solutions of Bodies; it remains now that we speak of Precipitation, this is performed only in Liquids, which, when as they are stuffed with Heterogeneous Particles, are compelled by a matter Precipitating those Particles, to separate one from another, and to obtain for their substance, divers places and conditions: wherefore, since in this operation, there is an agitation and motion of parts, its consideration ought to be referred to the Doctrine of Fermentation.

Precipitation is performed, either in Natural things, as chiefly in Milk, Blood, Urine, and perhaps in some others; or in Artificial things, which are of a diverse Kind and Nature: but they may be described and ranked in a certain order, according as the Liquor to be Precipitated, or Precipitating, is either Spirituous, Sulphureous, Watery, or Saline: besides, according as the Particles separated from the rest, are either Elementary, (*viz.* either Sulphureous, Earthy, or Saline) or Integral, which participate of the Nature of the whole mixture, and are only very small portions of it very much broken.

There are two common and known ways of Precipitation, whereby is made from Milk, both Cheese, and Butter: As to the first, if any sharp thing be poured into warm Milk, the thicker and Cheesie parts, presently separate from the serous and thinner, and are gathered together into a thick substance. The reason of which consists in this: Milk has a somewhat thick consistence, and its pores and passages are very much beset, with the thicker (to wit the Cheesie) contents; wherefore when something more subtil and penetrating, (as is Rennet) passes through the Liquor, it easily thrusts forth the more thick Particles, with which the pores were possessed; which then mutually Embrace one another, and are separated a-part from the thin, and Wheyie Liquor. When Milk is kept long to a sourness, it is Precipitated after the same manner, without Rennet, by warming it over the fire. For in stale Milk its Saline parts get a Flux, then being stirred up by the fire, supply by their own sourness the turn of Rennet, yea it is not improbable that the fluid Salt in the Rennet provokes the Saline Particles of the Milk, into a Flux, and that for this reason chiefly its Coagulation succeeds: for that the Saline parts having gotten of their own accord a Flux, so bind the pores of the Liquor, that the more thick Contents are willingly exterminated from them: wherefore we do say, for that reason, the same thing happens, when a Flux of the same Salt is caused by some thing else put into it. But that the Coagulation of Milk happens, not only by reason of the passages and pores being possessed by a strange Body, the sign is; because the Salt of Tartar, tho exceeding Precipitatory, effects nothing of this, and this effect is excited almost only by four things. Sugar hinders the Precipitation of Milk, and many other Liquors, because it restrains the Flux of the Acetous Salt, and as it is easily Soluble, and its Particles are soft and blunt, they extrude not the former Contents implanted in the Liquor, but fill all vacuities, that afterwards there is no space whereby another Precipitating Liquor may unfold it self, and break into anothers quarters.

But Country people are wont to make Butter of the Flowers or Cream of Milk, kept for the most part to a sourness, only by shaking or Churning it. The reason of which (as it seems to me) is this: in Cream there is great plenty of Sulphur, with which also a mean portion of Salt and Earth is mixed, as may be conjectured, both by the sourness of the Liquor remaining of the Butter, or the Butter-Milk, and by its thicker consistency. In this mixture, the parts both Saline and Sulphureous are in motion, and a Flux: but as the Liquor is thicker they cannot presently fly away: wherefore it remains, that if the bond of the mixture be further loosened, they will separate into parts, and that first the Sulphureous Particles, which exceed the others in power, are Congregated together with a mutual embrace; wherefore these two things, the

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Churning of the Cream performs, *viz.* it brings the Sulphureous parts by their often obvolution together, whereby they do the better intangle themselves, and mutually ensnare one another; besides it breaks their mixture with the rest. For this reason, in the Winter time, (when Cream is thinner, and abounds less with Sulphur) Butter is hardly made. Besides the admixtion of Salt or Sugar wholly hinders its making; because by the coming between of those little Bodies, the Sulphureous parts are hindered, from a mutual adhesion.

The chief Precipitation of the blood, which is performed within a living Body, is made in the Reins; where, not without the strength of a certain Coagulum or Rennet, the serous matter is separated from the rest of the blood; just as Whey from Milk: For which reason Diuretical things are of the same Nature, as those which bring a Coagulation to Milk; and therefore, because they more Precipitate the blood by fusing it, they cause a large profusion of urine. The blood being sent forth of the Vessels, separates into various substances, by its own disposition: whilst it is warm, it is variously Precipitated, by some Liquors poured to it, (in like manner Urine) not without a pleasant Spectacle. If you pour upon warm blood the spirit of Wine, Harts Horn, Soot, Vitriol, or other Liquors, chiefly Spirituous or Saline, a wonderful Ebullition, and heat is stirred up; whence we may conjecture after what manner it grows turgid, in Feavers. But before the rest, the Salt of Tartar, and a Solution of Alum, procure both in Blood and in Urin, a great perturbation of the Liquor, and falling down of the parts: for these disturb all the Contents in the pores and passages of the Liquor, and by their striction, very much lock them up for a long time.

Precipitation in Artificial things is of greater note and use: for this for the most part follows Dissolutions, and succeeds them as it were by a certain right of Order; because this takes out of their Jaws, and as it were lays by, the prey, which all *Menstrua* take by dissolving. According to the diversity of the *Menstruum*, and of the Body dissolved, Precipitation also variously happens: but in some Subjects there are two chief remarkable things, concerning the manner of Precipitation, to wit, the soluted Particles, immersed in the pores and passages of the *Menstruum*, are wont to fall out of them; either by reason of the narrowness of the containing space, or else by reason of the Contents being increased in weight and bigness: for in some the pores of the Solvent, being either leisurely bound up, or beset with a strange Body, shut forth from their Cells, the little Bodies of the thing soluted, and send them to the bottom; as may be observed in Sulphureous Solutions, or such as are made of the whole mixture of integral parts, in a thin Liquor; which are disturbed, and lay away their Contents by external cold, simple water, or at least by any Acid infusion. After this manner resinous Tinctures, also of Sulphur, Olibanum, Benzoin, and the infusions and decoctions of Vegetables, also Urin, Milk, and Blood, are wont to be Precipitated: but in several others, besides that the pores, and passages of the *Menstruum*, are either leisurely drawn together, or possessed by a new guest, also something new grows to the Particles of the thing soluted from the Precipitating matter, whereby being increased in weight and bulk, they can be no longer sustained; but that they are necessitated to sink to the bottom. This is chiefly seen in the Saline Solutions of Minerals, which are only Precipitated by the Salts; whose Particles presently cleave to the little Bodies of the thing soluted, and increase their substance, that presently they descend to the bottom by their own weight: For in Saline solutions, the little Bodies of the thing soluted, are strictly bound together by the fluid *Menstruum*, with the Saline Particles; and the Particles run hastily and are heaped together into the Embraces of the same fluid Salt, from the Precipitating infusion of the fixed Salt: wherefore, when these three, (to wit, the little Bodies of either Salt, and of the soluted matter) do cohere together, they constitute greater grains than can be contained in the narrow spaces of the *Menstruum*, and therefore being thrust out, they fall down towards the bottom: That this does truly happen after this manner, the great affinity, both of the fluid and fixed Salt, is a sign; that the Particles of both being placed near or mixed together, are presently combined in one: also, because many solutions of Minerals, are presently Precipitated by a fixed Salt, but not by Vitriol or Alum being put in, which do much more bind, and stop up the pores of the Liquor. Thirdly, it appears clearly even to sense, because that the matter put for a Precipitate, far exceeds the thing soluted in bulk and weight, and is impregnated by the fixed Salt adhering to it. But these being thus disposed, we will descend to the particular cases of Precipitations, forasmuch as Precipitation is made manifold, to wit, according to the diversity of the *Menstruum*, of the soluted matter, and the Precipitating infusion.

Simple

Simple water, though it do not well sustain the Particles of the mixture which it receives into it self by infusion, or Cohesion, yet hardly sends them away by Precipitation. For the pores of this *Menstruum* are too open and loose, wherefore the Precipitating matter, doth not easily strike the little Bodies of the thing soluted: in the mean time, by reason of the more loose frame of the *Menstruum*, some parts of the soluted Body sink down; others of their own accord evaporate, from whence that Liquor doth not long keep the Virtues or Tincture, with which they are impregnated by another. As some more thick parts and Terrestrial may be thrust down to the bottom, or otherways separated, we put in the Juice of Limons, or some acid thing, or boil in it the whites of Eggs, to wit, that whatsoever is thick might cleave to their viscous substance.

Spirituos and Sulphureous *Menstrua*, being impregnated with the Sulphureous Particles of the thing soluted, easily lay by their burthen; for they are Precipitated by common, or any Distilled water; as is seen in Sulphureous and Resinous Tinctures of Sulphur, Scammony, Benzoin, Frankincense, and others of that kind prepared by the Spirit of Wine, or Oyl of Turpentine, which presently grow Milky, by Water or Phlegm being infused. For in these sort of solutions, the pores are wholly possessed, that they admit nothing besides the thing soluted, and besides, both the Liquor, and soluted Matter are so thin, that they easily give place to any thing else being infused.

When *Menstruas* of this kind are filled with Saline Particles, as we may observe in the Tinctures of the Salt of Corals, of Tartar and such like, Precipitation does not presently succeed from common water, but from an Acid Liquor, as the Spirit of Vitriol, Salt, &c.

Saline *Menstruas* impregnated by the solutions of Stones or Metals, are most easily Precipitated by Saline Particles, and scarce by others. The chief Precipitatory Liquor, is the Salt of Tartar, or of Herbs burnt to Ashes, deliquated or melted; for this strikes back the Particles of every soluted thing whatsoever, and sends them headlong to the bottom; to wit, forasmuch, as it passes through every where, the little spaces of the solvent, and sticking to the Contents, increases them in bulk, that they more easily fall out of the pores of the *Menstruum*, bound also together with their own weight.

What fluid Salt (as Vinegar, Stygian waters, &c.) dissolves, the same a fixed Salt precipitates; and on the contrary: because Salt of Tartar being melted, most excellently penetrates common Sulphur, and receives the Tincture; which then is precipitated by a fluid Salt, viz. by the Spirit of Vitriol, and the like: which indeed does not happen, by reason of the disagreeing Particles of the Salts, and mutually opposing one another; but for that the same are greatly of kin, and rush into mutual Embraces: for from hence, the little grains of the thing soluted, by reason of the cohering of both the Salts together, being increased in bulk and weight, are more readily thrust out of the little spaces of the *Menstruum*, and descend to the bottom. We will in this place, more sparingly insist upon instances of this nature, because the more full handling of them belongs to the Chymical Work.

Precipitation is not only observed in the separation of a more thick matter, from a serous *latex*, and in the settling of the disturbed parts towards the bottom; but sometimes the Particles shut up within the pores and passages of the Liquor, are so small and subtil, that being Precipitated, they are not discerned by the sight, neither do they quickly descend to the bottom; but from their situation and position, being variously changed, the colour, and consistency of the Liquor, are diversly altered. I was wont in times past, to sport with the solutions of Vegetables and Minerals, which being made by themselves, were clear like Spring water, and appeared bright, being commixed, shewed now a Black colour, now a Milky, Red, Green, Blue, or some other kind. The solution of Saturn, (or Lead) being made with distilled Vinegar, appears bright like common water, if you add to this Oil of Tartar, like clear water, the mixture straight grows White like Milk. If Antimony calcined with Nitre, be boiled in Spring water, the straining seems clear, and almost without smell, which yet being dashed by any Acid thing, presently acquires a deep yellow colour, with a most wicked stink. Common water being imbued by an infusion of Mercury Sublimate, is presently tinged with yellowness, by Oyl of Tartar dropped into it. Quicksilver and Sal Armoniack, being beaten together, and Sublimated in a Matrace by the heat of Sand, go into a white powder, this being soluted by melting shows like to clear Spring water,

water, which yet being smeared upon Brass or Copper, appears like Silver; and being lightly rubbed on brasen Vessels, renders them as if they were perfectly silvered. A solution of Calcined Tin, being put to melted Salt of Tartar becomes bluish. A clear infusion of Galls, being mixt with a solution of Vitriol, makes Ink; if you add to this Spirit of Vitriol, or Stygian water, the black Liquor is by and by made clear like Spring water; and this Oil of Tartar reduces again to Ink. And what is more wonderful, if you write on Paper with the clear infusion of Vitriol, and frame any Letters; what you so write presently vanishes, nor is there any marks of the Characters left: but if you smear over the Paper with an infusion of Galls, presently the Letters may be read, as if wrote with Ink; which yet, with a Pen run over, dipt in Spirit of Vitriol, you may put quite out at once wetting, and then again render them, with wetting them with another Liquor of Tartar. The Sky-colour Tincture of Violets, being dashed with Oil of Vitriol, becomes of a Purple colour: to which, if you add some drops of the Spirit of Harts Horn, that Purple colour is changed into Green. Brasil Wood, being infused in common water, leaves a very pleasant Tincture, like to Claret Wine; if you pour to this a little distilled Vinegar, the Liquor appears clear like White Wine: a few drops of Oil of Tartar reduces it to a deep Purple colour: then if the Spirit of Vitriol be poured in, it becomes of a pale yellow, like to Sack; if you add the Salt of Lead, being soluted by deliquation, the mixture grows presently Milky: by this means you may imitate that famous Water-drinker, who having swallowed down a great deal of Spring water, was wont to vomit forth into Glasses placed before him, diversly coloured Liquors, resembling the ideas of divers kinds of Wines: for Glasses being medicated with the aforesaid Tinctures, (so lightly that they may not be perceived by the standers by) will not only cause the water poured into them, to imitate every Wine, but will exhibit the very Proteus himself of the Poets, changed into waters, and from thence putting on all colours, and infinite forms.

If a Reason of these kind of appearances be asked, it ought to be sought in the minute Particles, contained within the pores of every Liquor; which as to their site and position, being diversly altered, by another Liquor infused, transmit variously the Rays of Light, many ways break or reflect them, and so make divers appearances of colours. For when the Rays of Light pass through almost in right Lines, they make a clear colour like Spring water; but if in their passage, they be a little broken, the Liquor grows yellowish; but being more refracted, they cause a red colour; if they are bowed back, so as to be drained, or that they cannot shew themselves, a dark or black colour arises; but if they are again reflected, to the outmost Superficies of the Liquor, they create the image of Whiteness: after this manner we might variously Philosophise about other colours, and their appearances, the diversity of which, and sudden alterations in Liquids, depend chiefly on Precipitation: because, as the Particles contained in the Liquor, are driven sometimes more near by another infusion that they clasp themselves together; sometimes are ordered into other series of positions, the diverse representation of colours is made. For Liquor being impregnated with little Bodies or Atoms, or this Nature, most minutely broken, seems as an Army of Soldiers placed in their Ranks, who now draw into close Order, now open their Files and Ranks, now turn to the left, now to the right hand, as is diversly shown in the exercising of Tactics, or the Art Military. When two clear Liquors being mixed together shall make Ink, it is because the Particles contained in either, approach near one another, and as it were placed in their close Orders hinder the passage of the beams of light: when afterwards, this Ink is made clear by another Liquor poured in, it is because the new Bodies of the thing put in, disperse abroad the former close joyned Particles, and drive them as it were into their open Orders.

C H A P. XII.

Of the motion of Fermentation, as it is to be observed in the Coagulation, and the Congelation of Bodies.

Coagulation and Congelation of Natural Bodies, no less than their Solution, depend only on these our Principles. The impropportionate mixture of these, and the exaltation, and powerfulness of some above others, are the cause of either. Spirit and Sulphur being loosened from the bond, do not only pull assunder the proper Subjects, but they set upon whatever is next them; and where they are mighty in number and strength, they affect nothing more than divorces and separations from the rest of the Principles, and suffer no delay: but on the contrary, Salts love to be united to the rest, and to be made into hard and solid substances; and being destitute of the Company of the rest, presently to enter into new Friendships, and desire only not to be joyned to any opposit. If at any time they are more impetuously moved, either by their own disposition, or being soluted, they destroy the substance of others, this thing seems to be done for this end, destinated as it were by Nature, that they might find out Subjects agreeable to themselves, and having through War obtained Peace, they might at length be more strictly united to them: wherefore when Saline *Menstruums* corrode Stones or Metals, they are Coagulated with their Particles, and grow together into diversly figured Crystals.

When we here treat of Coagulation, we do not take this word after the usual manner: to wit, as it is wont to be vulgarly usurped, when Milk is become congealed, that is, departs from its simple and equal Liquor into Heterogeneous substances, *viz.* Cheese, or Curds and Whey, or thick and thin; in like manner, when blood or other humors go into parts after that manner, they are said to be coagulated: also, we have elsewhere given this sense, to this word, tho to speak properly, these sort of motions ought rather to be referred to Precipitation than to Coagulation. But here we would have to be understood, by the term Coagulation, an alteration in Bodies of the same kind, as when things at first tender and soft, grow hard, into a stiff, and as it were stony matter: or any thing is said to coagulate, when Saline little Bodies being dispersed abroad in any Subject, begin to be congregated and joyned together, and from thence united, either among themselves or with Earth, produce out of a soft and fluid substance, a hard and compacted. This may be perceived in the shells clearly stony, of Fruits and Seed; in Bones and Horns of living Creatures, in Shells and Shelly scurffs of Fishes; all which indeed very much abound with an Alkali Salt, or the same Volatilized. Among Handicrafts, or preparations from human Industry, the Crystallisation, Vitricification of Salts, or making of Glasse, also the baking of Pots and Earthen ware, ought to be referred to Coagulation.

But it is properly called Congelation, when the Saline Particles, coming from elsewhere, strictly bind together the Subjects on which they fall, fix the Particles variously moved within the substance of the mixture, and gather them together, that by that means the whole becomes stiff, and as it were stony. We may behold these kind of effects in Ice and Frost, by which soft Mud, or fluid Springs of waters grow stiff, into a very Marble substance. Also the same is manifestly beheld, among the Operations of Art, in the confusions of some Salts, and mutual Concretion in Sublimating; by which means, they go into a substance, now like to Ice, now to Snow. To which may be added the Artificial turning of water to Ice, which is performed by the mixture of Salt and Snow; but the instances which we have remarked in either of these, about the Works of Art, we will in this place briefly run through, and a little consider the reasons of them, and the ways of being done.

The Crystallisation of Salts, is procured after this manner; Salts of every kind are thoroughly dissolved in common water, and their Particles being dispersed through the whole mass of the Liquor, wholly disappear; afterwards, if this liquor be somewhat

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evaporated, that its passages and pores be something bound together, the little Bodies of the Salt close one with another, and mutually take hold of themselves, and joyn together, the outward cold binding them, and are figured in the midst of the water, into Crystals proper to their Nature. By this means *Sal Nitre* into Pyramids, Sea Salt into Cubes, Alum into eight cornered Figures, *Sal Armoniack* into six cornered, and other Salts are formed into other Figures of their own accord, after a constant manner.

If the Reason of this be sought after, we say that these kind of Salts are not simple Elements, but Bodies made up of abundance of Salt, with the other Elements mixed with them in small quantity; which even as other Natural Concretes, are allotted by the first Creator, peculiar manners of figurations, according to the surpassing strength of Salt and Spirit, and commixion with the rest. For in determining the Figures of Natural Bodies, Spirit and Salt are as the Rule and Compass in describing Mathematical Figures: Spirit, as the moveable Foot of the Compass, or as a Penfil in the hand of an Artist, variously excurs and draws here and there diverse fashioned lineaments. But salt (as the applied Rule) moderates the excursions of the other, and determinates them, and restrains them within the confines designed by Nature: when the Spirit is more powerful than the Salt, there happens a greater variety in the Figuration of things, as in Vegetables and Animals; because the Spirit running forth more largely, forms very many Marks of its Pourtraicture, and describes Bodies not in right Lines, but intorted, and very much variegated. Where the Salt Lords it over the Spirit, as in Mineral Concretes, and chiefly Saline; Bodies grow together in less adorned Figures, and are accounted the first and more simple, and of that sort, as the Mathematical descriptions in right Lines or Circles. For those Salts, are as it were second Elements; and from the implanting of them in Bodies, the proper and native Figures of things, very much depend; and therefore they themselves are primitively imbued by Nature with a certain Elementary Configuration, (so that according to *Plato*, God in truth exercises Geometry) and the first regular Figures are formed in the more simple, that things compounded of them, might arise furnished with all manner of variety of figures.

The fixed Salts of Herbs being prepared by Calcination, because they are almost destitute of the Fellowship of Spirits, do scarce go at all into Crystals, nor are they coagulated, but by a long evaporation. Sea Salt containing a very little Spirit, with great Labour goes into Cubes. Next to this Alum, guisted with a little more Spirit, is more easily coagulated, and grows into more elaborate Figures, *viz.* eight cornered. *Sal Nitre*, swelling with spirit, is most easily coagulated, and is framed into a more perfect Figure, *viz.* Pyramidical; which consists of both Spherical, and Right Lines. But Volatile Salt, (such as is distilled out of Urine, Blood, and the Horns of living Creatures) being associated with a plentiful Spirit, is drawn into Concretes, very much varying, which imitate now the Horns of Staggs, now the Figures of Plants. Out of Mercury, with Salt, or the Calx of Silver, by an Amalgama, in the midst of the waters a Silver Tree is formed, with Stock, Trunk and Branches, painted to the Life. It is a usual thing in the Winter time, for the Air, impregnated with Saline Vapors, and fallen on the Glass Windows, to be condensed into most fair Figures of Trees and Woods. So much for the Crystallisation of Salts: The other Species of Coagulation, is Vitrification, of which we will speak next.

Vitrification (which is also said to be the last mutation of Bodies, of which Nature is capable, and from which there is no going back) depends upon a fused Salt, and united to an Earthy matter, even to its smallest Particle: for when either matter is fused, by a most vehement fire, and divided in its smallest parts, the Bodies of either, being put into a Flux, are by so strict a marriage joyned together, that afterwards they are never to be pulled assunder.

There are many ways, and diverse provisions of Vitrification, to wit, of *Sal Alkali*, with Sand or a sandy matter fused together by a violent fire, common Glass is made; which is transparent, both by reason of the abundance of Salt, and of the clearness of the Sand; for if you behold the little Sands of which Glass is made, with a Microscope, each of their little Globes appear, (as they were Glassie Gems) clear and shining. Wherefore Salt promotes the fusion of that clear matter by fire, and then is admitted into its most strict embraces being fused.

Besides Glasses of diverse Colours and Consistences are made of Minium, the Calx of Tinn, Antimony, and some other Minerals; (when the Sulphureous part doth first
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fly away) fused, now by themselves, now with Flint or Sandy matter. The reason of all which consists in this; that Salt and Earth, being most finely broken by a violent fusion of fire, and being divided as to their least Particles; catch hold of one another, and so are bound together, by the most strict bond of the mixture. The Coalition or Coupling of these, is never to be dissolved, because there is wanting within in the mixture, other Principles, which might unlock the frame of the Subject: yea Salt and Earth, being joyned by the mediating fire, do so intimately cohere, that they affect not divorces of themselves, nor suffer them from another.

The baking of Earthen Pots and Bricks, is of kin to Vitrification (or making of Glafs) whereby moist and soft Clay is stified into a very stony hardness: But in these, there is greater plenty of Earth, and less of Salt; wherefore they are less brittle, and not transparent. Concerning these we say, that by the fire mediating, and as it were handying the smallest, broken, and divided Particles of Salt, are married to every Particle of the Earthy matter, and with them grow hard, into as it were a stony substance, and that not easily to be resolved. Also in these kind of matters, prepared by human Industry, we imitate indeed, with an excellent Artifice, the Concretions of Bones and Stones, made by Nature in divers Families of Animals, Vegetables, and Minerals.

As to what respects Congelation; Salts of a diverse kind, do often meet together, and grow stiff, into as it were a new substance: But this happens many ways. Of these, some Salts being mixed together, presently grow together into Crystals: for the Acid Spirits of Minerals being added to the Salts of Tartar, or those made of the incineration of Vegetables turn into a white Coagulum like Snow, and with a spumeous or frothy Heat: The reason of which is, that the Particles of the Salt, having gotten a Flux, take hold of other Salts in the Spirit, Alcalifate by melting; but by reason of the first Particles of either, being made unlike, there arises a strife; then from the same consociated in one, that white settlement is made.

Not unlike the same manner, these Acetous Spirits, to wit, of Vitriol, Nitre, Salt, and others being mixed with Metals, while they corrode them, are Crystallised together with their Saline Particles: so the Spirits of Vitriol, Nitre, also Stygian waters, (which are only Salts having gotten a Flux) are formed into most elegant Crystals, in the dissolving of Silver, Iron, Copper, and other things. For Salts, even as Sulphur, being loosned from the mixture, dissolve other mixtures, and greedily desire to be united with the Homogeneous Particles of the same Subject.

There is another manner of Congelation, when Salts being mixed with some other matter, are elevated by Sublimation out of their Subjects, and then congeal the Particles of that new matter, which they carry away with them, and grow together with them (like a Meteor) on high: after this manner the Salts of Vitriol, Nitre and Sea-Salt, being sublimated with Mercury, are congealed as it were into a snowy substance: The same being sublimed with Antimony, go into a matter like Ice. After this manner the Natural Congelations, by which some Minerals, and chiefly Vitriols and Sulphurs, are begot in the Bowels of the Earth, may be imitated. For of Iron and Copper are prepared factitious Vitriols, which are very like the Natural: Of Antimony Sulphur is made, which answers to an hair our common Sulphur in taking fire, colour and smell: for example pour Oyl of Vitriol, to the height of a fingers breadth, upon pulverised Antimony; and let it be distilled in a Retort in a Sand Furnace, a yellow Sulphur will be sublimed in the Neck of the Retort, that cannot be discerned from the common Sulphur: which is a sign that the Concretion of Sulphur is made in the Earth, when some Sulphureous Mineral is corroded by the Salt of Vitriol; whose Sulphureous parts are congealed by the same Salt. This also is an Argument, that Oyl of Sulphur, which is separated, by inkindling under a Bell from the Sulphureous matter, is nothing else but Vitriolic Salt, nor doth any thing differ from Oyl of Vitriol.

Artificial Congelation concludes instances and examples of Congelations: to wit; whereby common water, or any Liquors being put over the fire, or in an Hot House, are suddenly congealed into Ice: 'tis a common way, and vulgarly known, Salt being mixed with Snow and Ice, and agitated or shaken in a Vessel put into water, suddenly the water about the sides of the Vessel will be frozen. This will be done if you make tryal of it, either with common Salt, or Sea-Salt, Nitre, or also with Vitriol, Alum, *Sal Armoniac*, or Mercury Sublimate: For Salt of every kind, being put to Snow or Ice, loosens their mixtures, and sends away the Nitrous and Conge-

lative Particles from the Subjects; which presently being immerfed in the neighbouring water, Congeal it, as if they were freshly blown from the North.

What is more admirable; let a difh with Snow be placed over hot Coals, and in the middle of the Snow put a Glafs full of water: as the Snow is melted by degrees by the fire, the water fhall be frozen: for the Nitrous Particles, being driven away by the heat, by their departure, they are dafhed againft the neighbouring water and congeal it.

And thus much for FERMENTATION in general, and briefly of its various parts; it had been almoft an infinite Labour, and from our purpofe, to heap up inftances in fo diffufe a thing. Thofe hitherto brought, however chofen out of Natural Philofophy, were fit to wait upon the following Medical differtation, that we may more happily know the Original, Progreff, and State, as alfo the Remedies and Cure of Motions, and Mutations, in Caufes, which variously happen to all kind of Bodies, and fomewhat refpecting the Tumults, which from thence are begot in the human Body, from the blood being irritated, and the reft of the humors; to which exercife, God willing, we will now proceed.

F I N I S.

THE PREFACE.

To the Friendly Reader,



O Institute in this Age a new Doctrine of Feavers, may perhaps seem the same thing, as if any one should go about to describe the midst of our Country, for a Land before unknown. For what respect the Diagnosis of this Disease, seem to be firmly Established already, by the Precepts and Practice of the Antients and Moderns; yea by long Experience, they are so generally in the mouth, and known of all men, that nothing can be more. However I deserve pardon, if I a little receed from the Vulgar Opinion concerning Feavers, as a way mightily worn out; and go in a less trodden Path; because I am not the first, or only man that directs his course against the received Opinion, as against a Stream. For in truth, in the Medical Art, (and that deservedly) those things have not pleased the men of our Age, which did those of the former: because the Antients relying on a false Position concerning the motion of the Blood, proceeding as it were through slippery and moist places, often fell foully and dangerously: wherefore it is no wonder, if those who come after should take care for the thorough instauration of Physick, and for the Re-Edifying the Building, (as they say) even from the ground, the Antient Props being fallen down, on that which our most Famous Harvy hath laid, the Circulation of the Blood, as a new Foundation in Medicine. But in this Work, Learned men of other Countrys, but chiefly of our own, have happily laboured, not only in removing the Rubbish of the former Building, but for the supplying this plentifully with Stone, Planks, and other matter. In times past, among the Antients, as the distribution and Natural motion, of the Nutritious humor, of the Blood and Nervous juice; so the Feaverish heats, and preternatural motions of them, were wholly hidden and lay in the dark: but now new Lights have shined forth, and it is granted us to know the Causes of things before hidden, it doth not become prudent men, and professing Philosophy, even to shut their Eyes and remain blind in the Light it self; but especially about a Disease
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by which the third part of Mortals have still fallen to this day, to be rather willing to Err with the Antients, than to understand the Truth with the Moderns, or to believe what is more likely, argues a mind guilty of notable stubbornness. When therefore the *Puretology* or *Feaver Tracts* of former Medicine, had no firm and stable Basis, and that it is easie to shew that it was built upon very many, and plainly false Errors, what should hinder, but that we having gotten more certain Principles, should endeavour to erect a better Science concerning Feavers? Truly I think it would hardly be, altho the pleas of the Antients, should be yet openly maintained in the Schools, but that many Physitians, who have a mind to look within the Bark, would frame new Hypotheses to themselves from their own Ratiocination, by which they might more exactly quadrate the Phenomena of Feavers, than by that of the Antients. But it may be objected, that Feavers have been happily cured by the same Remedies, and the like method of Curing, from the times of Hippocrates and Galen, even to our days; and therefore it may seem a rash Work and little safe, that we should endeavour new things, after having had the Experience of so many Ages, especially since it is about the human Body. To this it will be easie to answer, that Medicine was at first Empirical, and Remedies were not invented by general Precepts, or by Rule, but by the frequent trial of several things: And if led by the Example of Hippocrates, his Followers had only polished his Observations and Experiments, without doubt the Medicinal Art had grown up better, more handsomly, and with greater benefit to the Sick. But that the Light, clearly inkindled by the Antients, did so suddenly shut up, and darkned the Eyes of Posterity, it was, the preposterous study of those, who too hastily framed, almost out of their own Brain, Physick into a general Method, after the manner of some Speculative Science: for by this means, before they had laid a firm Foundation, a sufficiently specious, and deceitful Pile of unstable Doctrine, was erected. That therefore in the Cure of Feavers, some Indications being more antiently received, remain yet confirmed, and are to be perpetually observed, is to be ascribed wholly to Experience, the first Mistress of this Art, and not to the Precepts of Scholars. And from hence, I hope for my self, to have gotten a defence sufficient enough; for if the Opinions wholly erronious of the Antients, had not hindered, but that the practice of Medicine, at first instituted by a certain induction of observations; had proceeded commodiously enough; the Theory being joyned with Truth, would have brought much less hurt to the Sick; or have less carried away those exercising Medicine,

cine, quite contrary from that Path, which Antiquity had left commended to us. In the mean time, 'tis not to be dissembled, that naked Experience, without the helps of Method and Reason avails little, yea very often doth much hurt; for neither are the same Diseases, every where to be driven away by the same Remedies. But he seems to have hit the mark, who joyns both together, that Reason may not pervert Experiments, and Nature it self, not that this may remove Reason from its place. Altho that I know well enough, I have not obtained it, yet I will freely profess, that I have aimed at this Mark; and perhaps I may have deserved some praise, even in failing in these sort of Adventures; for after I had not found in Books, what might satisfie a mind desirous of Truth, I resolved with my self, to search into living and breathing Examples: and therefore sitting oftentimes by the Sick, I was wont carefully to search out their Cases, to weigh all the symptoms, and to put them, with exact Diaries of the Diseases, into writing; then diligently to meditate on these, and to compare some with others; and then began to adapt general Notions from particular Events: and when by this means, for a long time, observing the Accidents and Courses of Feavers, I had busied my self, for the finding out forms of Reasons for their Cure, at length a new Pathology of this Disease was conceived in my mind; which afterwards, by the frequent increasing Concourse of Observations, as it were the Juice and Blood, was formed by degrees into a Child, such as it now appears. But the Infant, which I had ordered to be kept closely, in our private house, being remarkable for Paradoxes, as it were a monstrous shape, the importune diligence of Friends has taken care to bring abroad being gotten forth of my hands, and to be publickly beheld. What therefore is there said concerning Feavers, besides the common manner, I would not have any one esteem it brought forth by me, as from a Doctor in the Chair: doubting, I bring these thoughts into Public, and submit them to the Examination and Emendation of the more Learned. That others before me have not spoken all things truly concerning this thing, shall be an Argument that I may Err, yea (if you please) that I have Erred: however, if I should have rightly traced forth any marks, in this, at least new search of Truth; and shall have incited others (who are far better able) by this occasion, to the full finishing of it; it will not repent me altogether of this, tho rash beginning.

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F E A V E R S.

C H A P. I.

The Anatomy of the Blood; and its Resolution into five Principles: A comparing it with Wine and Milk.



THE Doctrine of Fermentation being explicated, it remains that we handle the chief Instance or Example of it, to wit *Feavers*. For it seems that a Feaver is only a Fermentation, or immoderate Heat, brought into the blood and humors. Its name is derived from *Februo* (or *Purgament*, which also is derived from *Ferveo* to be Hot) which word indeed is commodiously put to every Feaver, for that the blood in this Disease grows hot, and besides, by its fervor, as working must, it is Purged from its filthinesses. But that this Fermentation or Feaverish effervescency, may be rightly explicated, these three things are to be considered. First, What the Fermenting Liquor is; whether only blood, or any humors besides. Secondly, In what Principles in the mixture, and in what proportion of them, this Liquor consists. Thirdly and lastly, By what motion and turgescency of those parts, or Particles, of which the blood is made, the Feaverish effervescency is stirred up. These being thus premised, the Doctrin of Feavers shall be delivered, not from the Opinions of others, but according to the comparisons of Reasons, picked (tho from ours, yet) from diligent and frequent observation, and confirmed by certain Experiments; all which however, I willingly submit to the judgment of the more skilful.

It plainly appears, even to the sense, that the Blood doth hugely boil up and rage in a Feaver, for every one (tho rude and unskilful) being in a Feaver, complains of the blood being distempered, and of the same growing hot in the Vessels, and as it were put into a fury. Also, besides the blood raging in the Veins and Arteries, it may be lawfully suspected, that that juice with which the Brain and Nervous parts are watered, is wont oftentimes to be in fault; for when this Liquor is seen to be carried back from the blood, into the Nervous stock by a constant motion, and certain Circulation, and from thence through the Lymphatick Vessels, into the Bosom of the blood, it is probable, if by reason of a taint contracted from the blood, that humor be depraved in its disposition, or is perverted from its equal motion, that from thence, the Rigor, and Pain, Convulsion, Delirium, Phrensie, and many more symptoms of the Nervous kind, usual in Feavers, do arise.

After the Blood and Nervous Liquor, two other humors, for that being apt to grow hot, fall into our consideration, viz. The Chyme or nourishing Juice, continually coming to the Mass of Blood, and the serous Latex, perpetually departing from the same, which tho they be the first and last Liquors separated from the Blood, and distinct from it, yet being confused with it, they ought to be esteemed as its associate parts, or complements: For the nourishable Juice being fresh brought, is accounted the crude part of the blood, and to be assimilated; and the *Serum*, its stale part, and to be carried away. And after this manner, so long as either are Circulated with the

blood it self, in the Vessels they participate of the heats of the first begotten blood, and oftentimes occasionally begin them, or increase them being begun: but by what means these things come to be done, is declared hereafter in their proper places. As to the rest of humors, which are only the recrements of the Nutritious juice, or the blood, when they are included, either in their proper Receptacles, or constrained in the narrow spaces, in the Viscera, neither wash the several parts of the Body with a continual lustration, as the blood or Nervous Liquor, or the other humors but now recited, are to be exempted from this rank; sometimes perhaps they may be the occasional cause that the blood doth conceive an undue Effervescency, or that it persists in it longer; but it is only the blood, (with the Nervous Liquor, the alible juice, and *Serum* associates) which boiling up above measure, with its heat, and stirred up with a rage through the Vessels, diffuses the preternatural heat, and induces the formal reason of the Fever: but how this comes to be done, is not to be known plainly, but by a more near beholding the Nature of Blood, and as it were an Anatomy made of its Liquor.

There are in the Blood (as in all Fermentative Liquors) Heterogeneous Particles which as they are of a diverse Figure and Energy, remain a long while in the mixture, by their mutual opposing one another and subaction, the motion of Fermentation is continually conserved; as is perceived in Wine, Beer, and other Liquors: then, if the mixtion of the Liquor be somewhat unlocked by the adding of Ferments, the Native Particles being freed from their bonds, do yet more swell up, and induce Fermentation, with a more rapid motion and heat: which is seen in a familiar Experiment of the Chymists, *viz.* when fluid Salts are mixed with Saline Liquors of another kind; from thence a great heat and ebullition are stirred up. Wherefore we ought to inquire concerning the Blood, of what Particles it consists, that it should be fit to Ferment, (as Wine, Beer, and other Liquors) of its own Nature: then by the help of what kind of Ferments, both its Natural and Feaverish heats are performed, with warmth, and a more quick motion.

The Mass of the Blood by the opinion of the Antients, was thought to consist of four humors, to wit, Blood, Phlegm, Choler and Melancholy: and it was affirmed, that according to the eminency of this, or that humor, diverse temperaments are formed; and that by reason of their fervors or exorbitances, almost all Diseases do arise. This Opinion, tho it flourished from the time of *Galen*, in the Schools of Physicians, yet in our Age, in which the Circular motion of the Blood, and other affections of it were made known, before not understood, it began to be a little suspected; nor to be so generally made use of, for the solving the Phænomenas of Diseases: because these sort of humors do not constitute the blood, but what are so called (except the Blood) are only the recrements of the blood, which ought continually to be separated from it: For in truth the Blood is an only humor; not one thing about the Viscera, and another in the habit of the Body; nor is it moved at one time by Phlegm, and another time with Choler, or Melancholy, (as is commonly asserted) but the Liquor growing hot in the Vessels, is only Blood, and wheresoever it is carried through all the parts of the Body, it is still the same, and like it self. But because by reason of the abundance of the implanted heat in some, and because of the finalness of it in others, the Coction of the Aliment is now quicker, now slower performed in the Bowels, and in the Vessels; therefore the temper of the Blood (tho but one, and always the same Liquor) becomes diverse: and according to the various disposition of this, it may be said that men are Choleric, Melancholic, or of another temperament. Besides, because whilst the Blood is made in its Circulation in the Vessels, some parts continually grow Old, and others are supplied anew, hence from Crudity, or too much Coction, there is a necessity that what is excrementitious should be heaped together: which notwithstanding by its effervescency, (as by the working or depuration of Wines it comes to pass) it is separated from its Mass, *viz.* the watry humor, fixed in the Bowels, or solid parts, is it which is called Phlegm: some Reliques of adust Salt and Sulphur, being separated in the Liver, and received by the Choleduct Vessels are called Choler; the Earthy feculences being laid up in the Spleen, are termed Melancholy. In the mean time, the Blood if rightly purified ought to want Choler, Phlegm and Melancholy: even as when some Wines, or Beer are purified, the more light Particles are carried upwards, which constitute its Flowers or Head; and the dregs are prest down to the bottom, which grow together into Feces or Tartar: yet none can truly say it, Wine or Beer is composed of Froth, Tartar, and a Vinous Liquor,

quor. But as these humors, commonly so called, are made out of the other Principles, *viz.* Choler out of Salt and Sulphur, with an admixtion of Spirit and Water; and Melancholy, out of the same, with an addition of Earth; and as the blood is immediately forged out of these kind of Principles, and is wont to be resolved sensibly into the same, I thought best, the common acception of humors being laid aside, to bring into use these celebrated Principles of the Chymists, for the unfolding the Nature of the Blood and its affections. There are therefore in the blood as in all Liquors, apt to be Fermented, very much of Water and Spirit, a mean of Salt and Sulphur, and a little of Earth. The blood being loosned by putrefaction, exhibits the same separated and distinct. Also in the blood contained in the Vessels, or being fresh let out from them, we may discover their energies and effects: besides when in the Food, whereby we are fed, by the juice of which the Liquor of the blood is made, these same are implanted, no man will go about to deny that the blood also is made from them: wherefore I will briefly run through these, and endeavour to shew by what means the Consistency, the Properties, and the Affections of the Blood are made by them.

1. Spirits (which readily obtain the chief place) are a subtil, and greatly volatile portion of the blood. Their Particles, always expanded, and endeavouring to fly away do move about the more thick little Bodies of the rest, wherewith they are involved, and continually detain them in the motion of Fermentation. The Liquor of the blood, continually boils up with their effervescency or growing hot, and equal expansion in the Vessels, and the rest of the Principles are contained in an orderly motion, and within the bond of the exact mixture; if any Heterogeneous thing, or unagreeable to the mixture, be poured into the bloody Mass, presently the Spirits being disturbed in their motion rage, shake the blood, and force it to grow hugely hot, until what is extraneous, and not missible, is either subdued, and reduced, or cast out of doors. By the irradiation, or rather the irrigation or watering of these, the Bodies of the Nerves are inflated, the Functions of the Viscera, and also the Offices of motion, and sensation are performed: from the want of Spirits, also from their motion being depraved or hindred, arise great vices of the Natural œconomy or Government. The more quick motion and effervescency of these in the blood, (above what is in Wine) chiefly depends upon the Ferment of the Heart; because, whilst the blood passes through the Bosom of the Heart, its mixture is very much loosned, so that the Spirits, together with the Sulphureous Particles, being somewhat loosned, and as it were inkindled into a flame, leap forth, and are much expanded, and from thence they impart by their deflagration; a heat to the whole. By reason of this kind of expansion and suffusion of heat, there is made a continual expence of Spirits, which being rarified, as it were inkindled, continually fly away, and are evaporated forth a doors: and as long as we live there is made a continual reparation of these by aliments, chiefly the most delicate; which contain in themselves very much of Spirit and swelling matter: from which juice being drawn by digestion, and collated to the blood, is assimilated to it and fills up its defects. When the Blood of Animals is distilled, the Spirits (like *Aqua Vitæ*) ascend of a limpid colour, they are made very sharp and pricking, by the adhesion of the Salt; yet they are not so easily drawn off as the Spirits of Wine, but that there is need of a more intense fire to force them, because they are hardly driven from the fellowship of the thicker parts, with which they are involved.

2. That there is plenty of Sulphur in the blood, it is plainly seen, because we are chiefly fed with Fat and Sulphureous Aliments, also the Nutriment from the blood, carried to the solid parts, goes into Sulphur and Fatness. It is most likely, from the dissolution of this, that the red Tincture of the Blood doth arise: for Sulphureous Bodies, before any others, impart to the solvent *Menstruum*, a colour highly full of redness; and when by reason of too great Crudity, the Sulphur is less dissolved, the blood becomes watery and pale, that it will scarce dye a Linnen ragg red. The Mass of blood being impregnated with Sulphur, and together with Spirits, it becomes very Fermentable: which however, whilst it enters the Ventricles of the Heart, there suffers a greater effervescency, or rather accension; and on the Particles chiefly Sulphureous, being inflamed; and thence diffused through the whole, the lively and vital heat in us depends: When the Sulphureous part is carried forth, and doth too much lux-

uritate in the blood, it perverts its disposition from its due state, that therefore the blood being either depraved, or made more bilious or Cholerick, doth not rightly Cook the nourishing juice; or being inkindled throughout, it conceives heats and ardours such as arise in a continual Feaver. For the Sulphur being too much exalted; and swelling more than it ought, stirs up great heats in the blood: and they whose blood is more plentifully impregnated with Sulphur, are most obnoxious to Feavers. By reason of the Particles of this being incocted with the Nutritious juice, and from thence carried to the solid parts, fatness, softness and tenderness, come to our Body. From the Flesh or Blood putrefying, by reason of the abundance of evaporated Sulphur, a most evil stink breaths forth: In the distillation of Blood, Sulphur ascends under the form of a blackish Oyl, which also by reason of the Empyreuma, stinks most wickedly.

3. That Salt is in the blood, is evinced by the Salt; which, tho fixed, is drawn forth, by being eaten, from Vegetables, and from other eatable things, at first less volatile, afterwards by the most excellent digestion of Nature, and Circulation, is highly volatilised; that it passes through, not only without a remaining *Caput Mortuum*, all the members and parts of our Body, but also the blood being exposed to distillation, ascends the Alembic, and leaves the dead Head as insipid earth: If at any time the Saline Particles are not rightly exalted in the Blood, by reason of ill digestion, but remain crude, and for the most part fixed, from thence the blood becomes thick and unfit for Circulation, so that obstructions are begot in the bowels and solid parts, and serous Crudities are every where heaped together: But if the Salt be too much carried forth, and suffers a Flux, the Spirit being depressed, or deficient, a sour and bitter disposition is given to the blood, such as is observed in Scorbutical people, and those sick of a Quartan Feaver. Also from the Salt, for this reason being variously coagulated, the Stone, Kings-Evil, Gout, Leprosie, and very many other Chronical Diseases arise. But when Coction being rightly performed in the bowels and Vessels, the Salt is duly exalted, and being associated with the Spirit, is volatilised, then by reason of its mixture, the Liquor of the blood more equally ferments; also is defended from Putrefaction, Stagnation and Coagulation: Also the Saline Particles, bridle the fiercenesses of the Spirits, and especially of Sulphur; wherefore, those who have their blood well filled with a Volatile Salt, are less obnoxious to Feavers: also hence those who often are let blood, are more apt to Feavers.

4. Besides, There are in the blood (as it is a thick humour, and hath a gross consistence) many Earthy Particles: from hence also, its too great Volatilisation is as it were supported, and its too hasty accension hindered: even as Charcoal-dust, is added oftentimes to Gun-Powder in a greater proportion, that all its parts may not take fire at once, and too soon. Further, from the Terrestrial Particles of the blood, and Nutritious Juice, the bulk and increase of the Body proceeds. Lastly from the distillation of the Blood, a light and friable *Caput Mortuum*, is left in great plenty.

5. Upon the watery part of the blood depends its fluidness; for from hence its stagnation is hindered, and the blood is circulated in the Vessels, without growing thick or stiff: also its too great conflagration, and adustion is restrained, and its heat attempered. When blood is distilled a clear and insipid water is drawn off, at least in a double proportion to the rest; for from hence the matter of Urine, Sweat, and every humid Excrement, for the most part proceeds.

What things were but now asserted, concerning the Principles of the blood, and the affections to be deduced thence, will better appear, if we consider a little the blood according to its sensible parts, and shall compare it with other Liquors which are in daily use among us. Those sort of Liquors, which have a very great Analogy with the blood, are *v. z.* Rich Wine and Milk. As to the reasons of Fermentation and growing Hot, it is most fitly compared to Wine; as to its consistency, coagulation, and departure of the parts one from another, it is likened to Milk.

In the first place therefore, it is observed of Wine, that so long as it is shut up in the Vessel or Pipe, its subtil and spirituous Particles, do perpetually agitate, or very much shake others more thick, break them, and render them fit for an exact mixtion; what is heterogeneous, and unfit for subaction or mingling, is separated by its growing hot: In the mean time the purified Liquor greatly fermenting is in perpetual motion,

tion, whereby all the parts (as Atoms variously moved up and down, in a beam or streak of light) do stretch themselves forth onevery side, and contend with a constant rowling about, from top to bottom, and from thence to the top again. By the attrition and retraction of the Particles very many *Effluvia* of Atoms, go away from the Liquor, which if the Vessel being closely shut, they are kept within; the Liquor grows too excessively hot, and oftentimes causes the containing Vessel to burst in pieces. Blood, much after the same manner being shut up within the Veins and the Arteries, is urged with a constant Circulation: The Vital Spirit makes subtil, breaks, and exactly molds the more thick Particles; what is heterogeneous, and not mixable, it expels forth of doors; in the mean time by the refraction and kneading of the parts, *Effluvia* of heat do constantly stream forth, and evaporate through the pores; which being shut in, if transpiration be hindred, presently by reason of the too great boyling of the blood a Feaver is inkindled.

Secondly, we will observe concerning Wines, that they grow turgid, or swell up, if any extraneous thing, and of a Fermentative Nature, be poured to them; yea sometimes, that they are moved more than ordinary of their own accord. For, when by a long digestion, the Sulphureous part of the Wine is too much exalted, it conceives a greater heat than it ought, and (unless presently appeased) perverts the disposition of the whole Liquor, with its swelling up. It seems to be for the very like reason, that the Feaverish heat which is wont to be introduced by reason of the same Causes, is stirred up in the blood, as shall be shown in the next Chapter, where we treat of the Motion and Heat of the blood.

The third Observation, or comparing of the Blood with Wine, shall be of this sort: Wines (as also many other Liquors, as for example, Beer, or Sider) have their times of crudity, maturation, and defection. For when they are first made, the Spirituous parts are so obvolv'd by the others more thick, that they shew themselves but little, and put forth almost nothing of strength or virtue: and as the other Particles, are not yet subtilised, nor truly concocted, the whole Liquor remains crude, and of an ungrateful tast; and if put to distillation, not any Spirit ascends. From this state it comes by degrees to perfection, and when the Spirits being extricated from their intanglements, obtain their own right, and have subtilized and exalted the more thick Particles of the rest, the whole mass of the Liquor becomes Clear, Spirituous, Sweet and Balsamick. Lastly, when by a long Fermentation, the Spirits are consumed, and begin at length to fail, the state of defection is induced, whereby Wines, and other Liquors, either pass into a tastelessness, or at last the Salt and the Sulphur being too much exalted, are made sour or unsavory. In like manner the blood also, while it is Circulated in the Vessels, may be considered according to this kind of threefold disposition: First, in the making or crudity, which has relation to the Chyme new made in the *Viscera*, and freshly poured to the blood; the Particles of which, like to unripe Fruit, are crude and undigested. Secondly, In the perfect state or maturation, which belongs to the blood being sufficiently wrought, and made Volatile, according to all its Particles after it is inspired by Ferments, and its inkindling in the heart exalted. Thirdly, in its defection, which respects the blood; after it hath burned forth, and its Spirituous parts are very much flown away, and the rest growing old and poor, have need to be removed; and so they are either the Reliques of Salt, which are with the *Serum* strained forth continually by the Urine; or they are Particles of Salt and Sulphur, boyled and baked together, which are strained forth by the virtue of the Liver into the choleduct Vessels: or lastly, they are dregs and earthy recrements of the blood it self, which are carried into the Spleen, and there (as it were a *Caput Mortuum*, exalted by a new digestion) go into a Ferment, at length to be transmitted to the blood. Whilst after this manner, the generation of the blood, and its due maturation are truly dispatched, it is pleasingly circulated within the Vessels, neither wanting in motion or heat, nor inordinately troubled with them. But if either the supplement of the nourishing Juice, be not made agreeable with the rest of the blood, nor assimilated with it, but that either by reason of the defect of Concoction, it is washed into a very crude humor, or because of its excess, it is rosted into a burnt matter; or if the blood growing old, does not lay aside what it casts off, and give way to a new Nutritious humor; I say, by reason of these kind of Vices, concerning Sanguification, or the making of blood, the blood is variously perverted from its due temper and equal motion, and now becomes Watery and Cold; now Sharp or Salt; now Acid, Austere, or by some other way degenerate, and sometimes obnoxious to stagnations, and sometimes also to immoderate heats.

We may observe these kind of degrees of crudity, coction, and defection, in the blood, both of the sound and of the sick : in healthful persons after a more plentiful repast, Surfeit, or hard drinking, when too much of *Serum* or of Juice, is poured to the blood, its whole mass being too much diluted with a crude humor, becomes more watery and less spirituous ; wherefore men are rendered sluggish, and unfit for motion or exercise. In sick persons the Phlegmatic Constitution of the Body, induces such a crudity of the bloody mass, as is discerned in the White Dropsie, the Dropsie, *Pica* or longing Disease, and the *Chlorosis* or Green-sickness. Also the state of this kind of crudity, comes in an intermitting Fever, and in truth is the cause of the Feaverish accession, viz. by reason of the dyscrasie of the blood ; the nourishing Juice being heaped up, is not assimilated to it, but for the most part goes into a crude, or otherwise degenerate matter ; with which, when the mass of the blood is filled to a plenitude, swelling up it brings on the fit.

The state of Maturation, Concoction being finished, happens in healthful persons, some hours after Eating, especially in the morning, to wit, when the supplement of the Chyme, is spiritualised, and as it were enkindled in the whole, by reiterated Circulations : for then men are made more nimble and lively, and more ready for studies, or any business.

The state of Defection, is in the blood of sound men after fasting long, hard labor, and want of Food, for then the Vital Spirit being very much evaporated, the mass of the blood begins to become as it were lifeless, wherefore they presently languish, and are made weak. Moreover, the blood by a too long Coction is burned, and grows bilous, from whence those accustomed to want Food, or fasting, for the most part become sad and melancholic. Some Diseases habitually induce such a disposition of the blood ; such are the Scurvy, the Yellow Jaundies, the Cachexia (or evil state of the Body when the nourishing Juice turns to ill humours) long Feavers, and most Chronical Diseases, in which, the whole mass of blood, passes from from a Spirituous, into either a sower, sharper, or austere Nature.

So much for the comparing of Blood with rich Wine ; what follows, being a similitude of it with Milk, consists in the diversity of the parts, and their settling apart, which is chiefly seen in its being let forth from the Veins, and grown cold in the dish. For when the heat and vital Spirit, which conserve all things in the mixture, are flown away, the remaining parts, depart from one another of themselves, and a separation of the thin from the thick, and of the *Serum* from the Fibrous blood is made. This sort of separation of the parts, succeeds almost after the same manner, as in the coagulation of Milk. There are in Milk, Buttery, Cheesie parts, and Whey. The like is in Blood, so long as it doth not much recede from its Natural temper : for it is good, when, being let forth of the Veins, it grows cold in the Porringer, its parts do settle after the same manner ; to wit, the more pure portion, and Sulphureous (like Cream) comes together on the Superficies, which in healthful people, looks brightly red, and this answers to the flowring, or head of the Milk : under this lies a Purple thick substance, which consists of little Thrids and Fibres joined together, and as it were concreted into a clotty substance or parenchyma, such as the Liver : For the heat being consumed, and the bond of the mixture loosened, the Fibrous parts lay hold on one another, and by their weight, settle into a more thick Coagulum, which answers to the Cheesie part of the Milk : In the mean time, the Serous or Wheyey parts, being thrust forth from the rest, get their own Nature, and constitute a clear Liquor, like water ; which as it is thinner, ascends to the top, and swims upon the rest. Further, as the Whey of Milk is wont to be further coagulated, and doth yet contain in it self some parts both Buttery and Cheesie, so this Liquor swimming on the blood, if it be exposed either to the fire, grows thick, like the White of an Egg a little rosted, or if an Acid Liquor be poured to it, will be precipitated into a white Coagulum. This being seen, some have thought this watery Latex, to be the nourishing juice, which imparts nourishment to the whole Body, from the mass of the blood, in the time of its Circulation, and that the rest of the blood, is only the Vehicle of Heat and Spirits, and serves for no other use. But to me it seems more likely, that in this watery Liquor is contained the nourishing juice, which is employed on the Nerves, and the commonly termed Spermatic parts, for nourishment is supplied to the Musculous stock, from the Fibrous blood of the Parenchyma, or the Liver, Lights, and Milt. After this manner, blood being not much vitiated, goes into parts like Milk ; but if it be exceedingly depraved, when it settles,

it shews a far different disposition, and as to its single Contents, is allotted into various appearances; for the Cream growing together on the top, is seen to be sometimes white, sometimes green, now yellow, or of livid or lead colour: also it becomes not tender, but very viscous or clammy, that like a Membrane, it can scarce be pulled in pieces. When the blood long growing hot with a Feaverish distemper, is let forth from the cut Vein, in its Superficies, instead of a Scarlet Cream, there grows together often a white skin, or of some other colour: the reason of which is, because the blood is thoroughly roasted, by too great Ebullition, and its more pure portion, as it were by a certain elixation, is boiled forth from a red and tender substance, to a white and tough; but if in the mean time the bloody mass be not sufficiently purged from the adust recrement of Salt and Sulphur, the colour of this little skin becomes yellow or livid, and therefore the water swimming over it, is often tinged by the same means. Further, the Purple Crassament or thick substance, is also various: *viz.* sometimes it is of a blackish colour, when the blood is scorched too much, by a long effervescency. When the Fibres are vitiated, as in the Liver, they grow not together, but the Liquor like Beasting Milk, remains somewhat thick, and yet fluid; which indeed argues a great corruption of the blood; as uses to happen, in a putrid Feaver, a very great Cachexy, sometimes the watery Latex is wanting, as in Hectical people, and in too great a Diaphoresis. Sometimes it superabounds, as in Dropical people, neither will the whole go into a white Coagulum, by heat: In some Cachectical people, the blood being made more watery, appears like watered flesh. I knew one, indued with a vicious habit of body, that was wont to have blood of a whitish colour, and like to Milk when it was let forth, and afterwards, when he grew better by Chalybiat Medicines, his blood was moderately red: but concerning the setting of the blood and its appearances, there is enough. But as blood being emitted from the Vessels by its coagulation and departure of the parts one from another, imitates the various substances of congealed Milk, so sometimes being shut within the Veins and Arteries, like same fused by a Coagulum, enters altogether into the like mutation from Morbific causes; by reason of which change, being hindred in its Circulation, or somewhere congealed and fixed according to its portions, it produces many distempers: for it seems, that from hence the Pleurisie, the Squinancy, the Inflammation of the Lungs, the Dysentery, take their Original, and to this Cause the Pestilent diseases, owe chiefly their deadliness; as shall be said hereafter in its place.

It is sufficient that we have hitherto drawn a parallel of the blood, from which comparison with Wine and Milk, may be gathered what sort of Particles and Substances, it comprehends in it self, *viz.* Spirituous, and very agil or nimble, (such as generous or rich Wine has) for the heat and motion; and besides soft and tender (such as are in Milk) for the nourishment of the Body. Yea also, this Analogy of it with Wine and Milk, is yet further confirmed by the use of them in our diet; out of which the blood is generated; forasmuch as Milk is the best and most simple Aliment, and with it Infants, and Children, who have need of a plentiful provision of blood are nourished chiefly: But Wine copiously begets vital Spirits before all other things, and being weak and fallen, excellently restores them, wherefore it is wont to be esteemed instead of Nectar for old men, or those of ripe years.

The Nature and Analysis of the blood flowing within the Vessels, being opened after this manner, the Nutritious Juice deserves yet our consideration, being supplied from the blood, and separated out of the mass of blood, for the nourishment of the solid parts, and cleaving to them (whereby it may be the better assimilated) like Dew. For the Nerves, Tendons, and the rest of the solid parts of the whole Body, are washed with a certain alible juice. The Vital Spirits, having obtained the Nervous Bodies for a Vehicle of this, blow them forth at length, and expeditiously execute the actions of Sense: also that humor coming upon the solid parts, and assimilated with them, enlarges their bulk and growth. This is not a place to inquire after the Origine, Birth, and manner of the dispensation of this: It shall suffice only, that we have noted, that it is supplied from the mass of blood, and (as it is rendered highly probable by the most Learned Doctor *Glisson*, and Doctor *Wharton*) after it hath past through the Nervous part by a certain Circulation, what remains, being now made as it were poor, and lifeless, is sent back by the Lymphatic Vessels, to the blood. Whilst this Juice, being little cocted, or purged from dregs, is sent from the depraved blood, to the Nervous parts, tis wont variously to irri-
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tate them into Cramps and Convulsive Motions; also, no few Symptoms in Feavers, arise by reason of the depravation, and irregular Motion of this Juice, as shall be more largely laid open in another place:

C H A P. II.

Of the Motion and Heats of the Blood.

SO much for the Anatomy of the Blood, as to its primary Elements and Constitutive parts, into which it is sensibly wont to be resolved; also as to its Affections, which appear clearly, by the comparing it with Wine and Milk: it remains for us next to enquire concerning the motion of the Blood, both Natural, (*viz.* by the help of what Ferment, and by what swelling up of parts, it is Circulated in a perpetual motion through the Vessels) and preternatural, *viz.* for what Causes, and what fury of parts, when it boils up above measure in the Vessels, and conceives Feaverish Effervescences. These being rightly unfolded and premised, we will enter upon the Doctrine of Feavers.

Concerning the Natural Motion of the Blood, we shall not here enquire of its Circulation, *viz.* by what Structure of the Heart and Vessels, it is wheeled about after a constant manner, as it were in a water Engine; but of its Fermentation, *viz.* by what mixtion of parts, and mutual action of them together among themselves (like Wine fermenting in the Ton) it continually boils up. And this kind of motion, (as it were truly an intestine war of the blood) depends both on the Heterogeneity of the parts of the blood it self, and on the various Ferments, which are breathed into the mass of the blood from the Bowels.

As to the first: those things which have altogether like Particles do not ferment, wherefore, neither distilled waters, Chymical Oils, Spirits of Wine, or other simple Liquors are moved, as hath been already observed: but I have said, that Blood, according to the Nature things quickly irritable, doth consist of a proportionate mixture of the Elements; in which Spirits, for that they are very nimble, continually strive to expand themselves and to fly away: but being intangled by the more thick Particles of the rest, they are detained in their flight. And being detained after this manner, they toss about, break to pieces, and very much subtilise the more thick little Bodies, by which they are hindered; they volatilise the Salt, otherwise fixed; by a most minute kneading, and by the adhesion of it, they perfectly dissolve the Sulphur, compacted in it self, and not miscible with the rest, and boil it in the *Serum*. They break the Earth, even to its smallest parts, and mingle it with the rest. But in the mean time, by the striking and molding the Salt and the Sulphur, *Effluvia's* of heat plentifully proceed, which being mixed with the rest, and on every side diffused, increase the motion of the Fermentation. And after this manner all being most minutely broken and diluted with watery Particles, they constitute the Liquor of the Blood: which, whilst in the Vessels, as Wine shut up in a Pipe, continually ferments, and, according to all its Particles is in perpetual motion.

But the Fermentation of Wine, and of Blood, differs in this: that in Wine there is no wasting of the old parts, and a coming again of new; but the Liquor being shut up in the Vessel, remains still the same: but 'tis otherwise in Blood, in which some parts are continually destroyed, and in their place others are always generated anew. In Wine, the times of crudity, maturation, and defection, are distinct, and are successively performed in the whole; In Blood, that threefold state is celebrated at the same time and by parts: Fermentation being once begun in Wine, is continued even to the end; but in Blood, because it is washed still with crude Juices, it ought still to be renewed; by which means, the Nutritious Particles, not of kin, are assimilated to the rest of the *Latex*; wherefore, for this work, besides the Fermentation once begun in the blood, there is need of some Ferments, which may continue the same, otherwise about to leave off.

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That Ferments are required for the making of Blood, this is an Argument; that when they are wanting by Nature, they are with good success supplied by the work of Art: for fixed Salts, *Alcaly* Salt, Extracts, Digestives, Openers, and especially Chalybeate Remedies, help for this reason, that, as it were by a certain Ferment, they restore anew, the weak, or almost extinct Ebullition or Boiling of the Blood.

As to what respects the Natural Ferments, very many may certainly be formed, and in divers parts, or hid in the Bowels: for any humor, in which the Particles of Salt, Sulphur or Spirit, being much exalted, are contained, puts on the Nature of a Ferment: after this manner, the flowing or dregs of Beer or new Wine, being kneaded with Meal, and the mass kept to a sourness, come under this rank, by which new Beer, and the like Liquors, as also the mass of Bread, are most excellently Fermented. In like manner in the Ventricle, a sourish humour participating of exalted Salt, there helps concoction: and in the Spleen, the feculencies of the Blood from Salt and Earth being exalted, go into a Ferment.

How much vigor comes to the Blood from the Womb and Genital parts appears from hence, because by the privation, or evil disposition of them, follow, in Maids the Green sickness, in men, barrenness or loss of virility, want of Beard, and a shrill voice. But the chief Ferment, that serves for sanguification, is established in the Heart; for this is the chief fire-place, in which the cruder Particles of the Chyme, are as it were inkindled, and acquire a volatileness: which thing may be confirmed by many reasons, but especially by its effects, which we suffer in the precordia, as often as the Blood ferments more or less than it ought to do: for when it is too much inkindled in the Heart, it is agitated impetuously, as it were by fires put under it; the signs of whose immoderate Ebullition are, a deep pulse and vehement, then almost an intolerable heat in the Precordia, with a vehement thirst; on the other side, when the Fermentation of the blood is lessened in the Heart, we are affected with an anhelous, and difficult respiration upon any motion; as may be perceived in the Dropsie, Cachexia, and Yellow Jaundice: the reason of which is, not because the Lungs are stuffed, or filled full of a tough or clammy matter; but because the blood doth not rightly ferment, in that Repository of Fermentation; wherefore, being fallen into its Bosom, it is not presently Rarified; nor doth it soon leap forth into the Lungs, but being apt to stagnate, and remain there, causes an oppression of the Heart it self; for the helping of which, frequent breathing is made, that the blood being let forth into the Lungs, succour might be brought to it: but if by motion or exercise, the blood be more provoked into its Ventricle, than can be derived by respiration, or the pulse, into the Pneumonic Vessels, there is danger of choaking. The like happens in those that are dying: when the pulse is very small, and the blood being heaped up in the Heart for want of Fermentation, begins to stagnate and to clodder, we then breath deeply, with a noise and elevation of the breast; to wit, the blood with the ultimate endeavour of Nature, and the whole force of the Lungs, as long as it is able to be done, is emptied forth into the Lungs, lest residing in the Heart, it should wholly choak it.

Therefore, Motion and Heat, in the Blood, depend chiefly on two things, *viz.* partly on its own proper disposition and constitution, by which, it being forged very greatly with active Principles of Spirits, Salt, and Sulphur, of its own accord swells up, or grows turgid in the Vessels, even as Wine in the Ton: and partly on the Ferment implanted in the Heart, which very much rarifies the Liquor passing through its Bosom, and makes it to leap forth with a frothy heat: that the blood, which is quietly instilled to the Heart through the Veins, running gently like a River, from thence leaping forth through the Arteries, (like a Torrent) with noise and rage, might be carried forward, to all the parts of the whole Body. By what means this is done, though it is not easie to explicate Mechanically, yet the manner, and some not improbable reasons of this thing, are delivered by most Learned men, *Ent, Cartes*, and others. They suppose indeed, as it were a fire to be set in the Chimny of the Heart, which presently inkindles the blood infused through the Veins, (even as a flame put to Wine burns it) which being so inkindled, by its deflagration (like lightning) passes most swiftly through the Arteries: so that heat, a most rapid motion, and *Effluvia* sent by Perspiration, are wont to proceed from the accension of the blood in the Heart only. *Hogelandus* affirms, that there is a Ferment hid in the Bosom of the Heart, that compels the Liquor of the blood to boil up, and to grow hot, with heat, and a plentiful emission of Soot, just like Spirit of Nitre, when it is poured on the Butter of Antimony: so that the

blood flowing in gently through the Veins, being forthwith Rarified into spume and vapour by the ferment of the Heart, runs very impetuously through the passages of the Arteries. Tis almost the same thing, whether it be said to be done, either by this, or by that way: for the alteration which the blood receives in the Heart, may be equally deduced from a flame, or a Nitrous Sulphureous ferment, there supposed to be placed. Because, whilst the blood slides into the Ventricles of the Heart, presently the frame of the Liquor is loosned, and the active Particles, especially the Spirituous and Sulphureous, the bond of the mixture being broke, do leap forth from the rest, and strive to expand themselves on every side; but being kept in by the Vessels, and being forced together with the remaining Liquor, through the open passages of the Arteries, they rush with violence, and swelling up by the way they can find, and by that means, diffuse *Effluvia* of heat, through the whole body: there is little difference, whether this expansion of the Particles of the blood, and exertion into the liberty of motion, be said to be done by Accension, or by Fermentation, forasmuch as by either way, the frame of the blood may be so unlocked, that from thence the Particles of Spirit, Salt, and especially of Sulphur, being incited into motion, (as it were by an inkindled fire) may impart heat to the whole Body.

But this Rarefaction, or Accension of the blood in the Heart, very much depends upon the disposition and constitution of the blood it self: for if its Liquor be rightly cocted, being made volatile, and (like rich Wine) brought to maturity, it then Ferments there after its due manner, whereby the soluted Particles of the Spirits and Sulphur, diffuse an equal, and moderate heat to all parts. But if the blood, by reason of an ill manner of feeding, and want of Concoction, be crude and watry, then it is less inkindled in the Heart; and from thence follow a frigid intemperance of the whole, difficult breathing and wheezing, with a weak pulse, and languishing; as in Cachectical people, those distempered with the Green Sickness, and such as are about to die, may be perceived: but if the blood becomes too luxuriant, and apt to grow turgid, by reason of plenty of Sulphur being carried forth, or of its *Effluvia* being restrained, or of eating hot things; either its Accension or Fermentation in the Heart, is very much increased, so that from thence a Feaverish heat, and greater effervescencies than usual, are stirred up in the whole. This various Fermentation of the blood in the Heart, according to the various temper of the same, may be illustrated by the example of Wine: fresh Must, that is yet crude, though it be boiled, or put on the fire, will not burn; but this being purified and brought to maturity, is easily inkindled, but sends forth a small flame, and quickly out. The same at first growing hot, or otherwise warmed, if inkindled, is greatly inflamed, and for the most part is consumed by its burning.

Whilst the Blood, after this manner being rarified, or inkindled in the Heart, and from thence growing hot, through the passages of the Vessels, is resolved into minute parts, some little bodies depart from its loosned frame, which refuse at last to be united, and fitted with the rest of the Liquor: but these are of a twofold Nature; either thin, which like smoke from the burning fire, or *Effluvia* from a Fermenting Liquor, do evaporate from the Liquor of the Blood, by a constant Diaphoresis, through the breathing holes of the Body; or more thick, which like ashes left after burning or the settling dregs after Fermentation, ought to be soon strained from the mass of Blood, and to be carried forth of doors: for otherwise, by their confusion, they produce notable perturbations in the Blood. Whereby the Blood growing more hot, is dissolved in the Heart, therefore these recrements, both Fuliginous and Earthy, are more plentifully heaped together; and when by reason of too great congestion, they cannot be presently subdued and secluded from the mass of Blood, they bring forth a swelling up of the Blood and Feaverish Heats.

Concerning the Motion, Heat, and Natural Fermentation of the Blood in the equal tenor of which, the means of our Health consists, what hath hitherto been spoken, shall suffice. We will treat a little more largely of the preternatural, or too great effervescency, on which the types, and Paroxysms of Feavers depend: I call that too much, or Preternatural Fermentation, when the Blood, (like a Pot boiling over the fire) grows hot above measure, and being rarified with a swelling spume, distends the Vessels, excites a more quick pulse, and like a Sulphureous Liquor having taken fire, diffuses a burning heat on every side.

This kind of motion or Fermentation of the Blood, will be best of all illustrated by an example of Wines growing hot. For Wines, besides the gentle and equal Fermentation,

mentation, by which they are at first purified, at some times do so remarkably grow hot, and boil up, that they fly out of the mouth of the Vessel, and if they are closely stopped up, cause it to burst in pieces. After this manner, as if struck with fury, unless they are immediately drawn away from the Tartar; or their Lees into another Vessel, they will not cease from growing hot, until the Spirit being very much loosened, and the Sulphur or Salt too much exalted, they are either made unsavory, or degenerate into a sowness.

Such an Effervescency is wont to be stirred up for two causes chiefly: First, When any extraneous thing, and not miscible, is poured into the Ton, (so some drops of Tallow, or Fat, being dropped into the Cask, will produce this motion) or secondly, when Wines being enriched with too rich a Lee or Tartar (by reason of the Sulphureous parts being above measure exalted) conceive heats of their own accord, and exceedingly boil up. For in whatsoever substance Sulphur abounds, and its Particles being loosened from the mixture, consociate together, and are bound close in one, there such immoderate heats are procured.

After a like (tho not wholly the same) manner, whereby Wines grow hot, the boiling up of the Blood is induced, to wit, either what is foreign, and not akin to the Blood, is mixed with it, that when it is not assimilated, is wont to cause a Perturbation, and growing hot, until that Heterogeneous thing, is either subdued or cast forth of doors; and the Particles of the Blood being confused and troubled, are at last shaken forth, and that they get again their former place and position in the mixture. Or, Secondly, the Blood grows hot above measure, because some Principle, or its constitutive Element, (*viz.* Spirit or Sulphur) is carried forth beyond its Natural temper, and becomes enraged; whereby indeed the Particles of this or that, being not agreeable to the rest, are loosened from the mixture; being loosened, they become more violent than they ought, shake much the Liquor of the Blood, and bring forth a heat, which is not allayed, till the Blood being as it were inflamed, burns forth with the long fire of a Fever. By either way, whether the Blood grows hot in the Vessels, by reason of the pouring in of a thing not miscible, or by reason of the rage of the Spirit, or Sulphur being carried forth, because from thence its frame is more loosened, therefore it is more inkindled in the Heart; and the active Particles first loosened from the Ferment there implanted, do grow exceeding hot, leap forth from the mixture, and disperse on every side by their motion, a strong heat, and as it were fiery: but yet with this difference, that the Effervency, which depends upon the mingling of some extraneous thing with the Blood, is for the most part short, or renewed, which, when what was Heterogeneous is separated or subdued, is quieted of its own accord, and the shaken parts of the Blood, and put out of order, easily return to their Natural site and disposition. But the Ebullition which arises from the inordination of the Spirit or Sulphur being enraged, is continual; to wit, here the whole mass of the Blood is so loosened, and dissolved from the strict bond of the mixture, that as an Oily Liquor having taken fire, it ceases not to grow hot, or to be inflamed, till the Particles of Spirit, or Sulphur, or the Combustible matter, be for the most part burnt out.

There remains yet a third manner of Preternatural Fervency, whereby the Blood is subject to alteration, which happens not to Wine, but most often to Milk; *viz.* when at any time, from a Morbific cause, a coagulation of its Liquor is induced, so that its substance is poured forth, and goes into parts, and there is a separation made of the thick and earthy from the thin; by which means the Blood is not fitly circulated in the Vessels, but that its congealed portions, being apt to be fixed in the extrem parts, or to stand still in the Heart, do interrupt the equal motion, or grievously hinder it: For the sake of the restoring of which Effervency, greater are wont to be stirred up in the Blood, to wit, such as happen ordinarily in a Plurisie, the Plague, Smallpox, or the Venereal Disease.

C H A P. III.

Of Intermitting Feavers or Agues.

BY the Premises which we have spoken of already, concerning the Anatomy, Motion, and Heats of the Blood, there now lies open an easie passage to the handling of Feavers. The Notions which are commonly set forth, concerning a Feaver, out of the force and Etymology of the word, I here purposely omit: It may be described after this manner, that it is, An inordinate motion of the Blood, and a too great Heat of it, with burning and thirst, and other Symptoms besides, whereby the Natural œconomy or Government, is variously disturbed. As we have remarked already, concerning the growing hot of the Blood, so now we do of a Feaver, that indeed, its accession is either short, and by fits, which is therefore termed Intermitting; or else great, and long protracted, which is called a continual Feaver. We will first speak of the Intermitting Feaver.

Tho an Intermitting Feaver, in our Popular Idiom, is known by a proper Name, and is distinguished contrary to a Feaver commonly taken, yet because it hath too great Effervency of the Blood joyned to it, it is to be called a Feaver. It is peculiar to this, from a continual Feaver, that it hath certain remissions, or times of intermission; that every fit begins with cold or shaking, for the most part, and ends in Sweat; that the accessions or coming of the fits, return at set Periods, and certain intervals of times, that a Clock is not more exact. Wherefore, we will first discourse concerning this Feaver in general, what sort of heat of the Blood it is which continues its fit, and from whence it is raised up. Secondly, Wherefore the fit appears equally with cold and shaking, as with sweat following. Thirdly, What may be the cause of the Intermission, as also of its certain set Periods. Fourthly and Lastly, Are added some irregularities of Intermitting Feavers, as when now cold, now heat or sweat is wanting; or when the Periods are wandring and uncertain, when the Remission or space of Intermission, is not equal, but now comes sooner, now later, and sometimes redoubled: and I will endeavor to shew the reasons of these: and of other Phenomena or appearances, which variously happen in this Distemper. These being laid open, we will go on to unfold in the next Chapter, the division of an Intermitting Feaver, and the kinds of it.

As to the first: The Effervency of the Blood in an Intermitting Feaver, (or Ague) for the time of the fit, is as violent and strong as in a continual Feaver: wherefore, it is concluded, that the parts of the Blood, among themselves, or some Heterogeneous thing being mixed with it, do strive together, and Ferment above measure. But there is required, that they may Ferment, or too greatly boil up among themselves, that some Principle, as chiefly Spirit or Sulphur, being too much exalted and enraged, do appear above the rest; which, when it cannot be yoked with them, brings in a continual strife and heat: but from this cause, a continual Feaver draws its rise, because such an Ebullition of the Blood, being once begun, is not suddenly allayed, and when it is appeased, it does not afterwards presently return. Wherefore for an Intermitting Feaver, 'tis to be supposed, that some Heterogeneous thing is mingled with the Blood, whose Particles, when they are not assimilated, make so long an Ebullition of the same, till either being kneaded, they are rendered miscible, or being subtilised, are shut forth of doors. Wherefore, such a matter being brought under, or shut forth of doors, the fit ceases, and when this matter springs again, it stirs up a new Ebullition, and so a new fit is brought on.

Concerning this Matter, which being mixed with the Blood, induces the periodical Heats, and the other Symptoms of an Intermitting Feaver, 'tis very ambiguously, and diversly disputed among Physicians, where it is generated, in what seat or place it lodges, and by what means it so exactly observes, the times of its Motion, and Ebullition. But it would be a work of too much labour and tediousness, to recount here all the Arguments, of the Ancients, and Moderns, to reduce them into order and to weigh their reasons; Wherefore, doubting, I propose what has come into
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my mind, when I thought deeply of the matter, and submit to the judgment of others.

Of necessity there is something, which brings in the Heat of the Blood exactly periodical, that is generated in our Body at the several periods, or accessions of the Fever, always in a set measure, and equal proportion, and is communicated to the mass of Blood; with which when the Blood is filled to a plenitude, it forthwith grows turgid, and conceives an heat: But this is supposed to be either an Excrementitious humor, sliding down into some Mines, which by degrees, and at a set time, being brought to an increase, and moved, Ferments with the Blood: or it is the nutritious Juice, supplied from the matter of Food, and delated in weight and measure, which, when it is not assimilated, by reason of a defect in sanguification, being heaped up to a fulness, for its own expulsion, induces a turgency in the Blood. The reason of Intermittent Fevers, is commonly explicated by the former way, and the causes of the Intermittion, and set times of approach, are fetched from the nature of the Humor, and the seat, or place where it is cherished. The Nest, or Mine of this Disease, almost by an unanimous consent, is fixed on the first shop of the Body, and from hence the reason of the Intermittion is fetched, and the continual difference of an Intermittent Fever: but they affirm the matter to be Choler, Phlegm, and Melancholy; and as these humors are said to putrify slower, or sooner, so the Feaverish courses, are said to be absolved, in the space of one or more days. But this Opinion, after the Circulation of the Blood hath been made plainly known to all, is deservedly rejected. For when the Blood never stagnates in the Vessels, but washes every place with a perpetual motion, and continually carries away their filth, it is impossible that the Mire of this Disease should subsist in the Mesaraick Veins, where it is commonly asserted to be: as to what belongs to the cavities or dens, for the heaping up of the humors in the Viscera, it neither appears, by what means such should be formed without a Tumor or Imposthume; nor by what instinct, such humors, shut up in their Nest, do increase, are consumed, and lastly spring forth again, at so exact intervals of times. Besides, what is affirmed concerning Bile, Phlegm, and Melancholy, and of their periodical motions, we hold wholly suspected; because these sort of humors, are not afforded sincere, such as are described in the Schools: but the Blood, having gotten a various disposition, now being hotter, now colder, its nature imitates the qualities of such humors; or in its Circulating, it lays aside its Recrements, which being deposited in little Chests or Vessels, are falsely believed to be Morbific, and Preternatural humors. Wherefore, as the nutritious Juice, is the only humor wherewith the mass of Blood is daily refreshed, and its supplements are made still in measure, and proportion, without doubt, the periodical heats of the Blood, are to be drawn from the accession and commixtion of this.

I have already remarked concerning the Particles of the Blood, a triple state of crudity, maturation, and defection: to wit, the nourishing Juice, supplied from the daily Food, comes crude, is mixed with the Blood, and being for some time Circulated, is assimilated to it, and is ripened into a perfect humor: afterwards growing stale, it goes into parts and is laid aside. Whilst after this equal manner, the Blood is continually restored, and its losses repaired, it very quietly Ferments, without any trouble, or immoderate heat, and is Circulated within the Vessels; but if the supplement of the nourishing Juice, is not (as before) ripened, nor goes into Blood, by a perfect digestion, its Particles being confused with the Blood, remain as it were some Heterogeneous thing, and not exactly akin, in the mass of Blood; with which, when it is filled to a plenitude, the Blood forthwith grows troubled, and conceives a Feaverish heat, whereby the fresh supply of this depraved Juice, is either overcome or cast forth of doors. I say therefore, from the first instant, in which the nourishing Juice is not assimilated with the Blood, its Particles, tho mixed with it, are as yet Circulated with it, without any great tumult or perturbation, and so afterwards till the mass of the Blood is filled with them to a turgency: but then it quickly boils up, and conceives a heat: almost after the same manner, as new Beer put into Bottles, which, if they are closely stopped, that nothing may evaporate, is at first contained in those Vessels, without heat or force; afterwards when the *Effluvia* being still restrained, the mass of the Liquor swells up, notably Ferments, and by reason of the force of Fermentation, oftentimes makes the Bottles fly in pieces: also this happens at a set time, and in the space of so many hours, as in an Intermittent Fever, the Liquor arises to its height of turgency.

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There yet remains a difficulty, for what cause the nutritious Juice, being confused with the Blood, is not assimilated, but degenerates into an Heterogeneous, and Fermentative matter : I suppose this to be done, for the most part, not by the default of the Aliments, nor yet of the Bowels, but by the vice of the Blood it self. For the Blood, even as Wine, sometimes passes from its native and genuine disposition, into an acid, sour, or austere disposition; and because the Blood makes Blood, it comes to pass, that when it is departed from its due temper, it easily perverts the provision of the nutritious Juice, by which it should be repaired. What that disposition of the Blood is, and by what means contracted, shall be told hereafter, when we speak of the kinds of Intermitting Feavers, and of their evident, and Procatarctick causes. The Heat, or Effervescency therefore of the Blood, which constitutes the fit of an Intermitting Fever, depends only upon the assimilation of the nourishing Juice being hindered; the Particles of this being commixed with the Blood, are not (as before) ripened, nor are made into perfect Blood; but by the mixture of these, the mass of Blood (as it were new drink) is imbued with little Bodies greatly Fermentative; when the which are more thickly heaped together, and the Blood is filled with them to a swelling up, it presently grows hot, and a mighty agitation, and strife of the Particles is made, by which, they break, and subtilise one another, till at length the vital Spirit getting the dominion, and the rest being brought under, what is extraneous is thrust forth of doors, from the company of which, the Blood being freed, the remission, and intermission of the aguish fit follows; but afterwards from a new supply of this Juice, a new fit is brought on.

Secondly, As to the shaking, or cold preceding the heat, in this Distemper, I say, when the Particles of the nourishing Juice, do proceed from a state of crudity, towards maturity, but do not attain it, they contract a notable sourishness, with which they greatly prick, and haule the nervous parts, and cause the sense of cold: even as new Beer, which being stopped close in Bottles, passes from a sweet into an acid and nitrous tast, that for the cuttingness and cold, can scarce be swallowed. When therefore, the Particles of this sort of crude Juice, being indued with a Nitrous sourness, do fill the mass of the Blood to a fulness, or to a swelling up, and when they being more thickly heaped together, begin to enter into a Flux, they first of all strike down the Vital Spirits, with their sharpness, and somewhat overthrow their heat; wherefore the Blood becomes colder, and is more slowly circulated: yea, and by reason of the defect of heat, the sense of cold is perceived in the whole Body, and a pulse very rare exists. Moreover, when the nervous and solid parts, are watered with this sort of acetous Juice, for their last nourishment, by the Flux of this, which happens together with the turgescency of the Blood, these sensible parts are pulled, and irritated into Tremblings and Convulsions. And this without doubt is the true and genuine cause of the cold and shaking, which are excited in a fit of the intermitting Fever; to wit, the Flux, and swelling up of the nourishing Juice, degenerated into a Nitrous matter, with which the Spirits and Heat being suffused, are blunted, and the Nervous Bodies being provoked, are moved into tremblings. But afterwards, when these Nitrous Particles being thrust forth, from some part, into the Superficies of the Body, the Blood is somewhat freed from their weight and oppression, the Vital Spirits recollect themselves, and begin to shine forth; but from thence a most intense heat succeeds, because, both the mass of Blood, by reason of the growing hot with the Feaverish matter, being loosened, and also its mixture being laxed, the Sulphureous Particles are more plentifully inkindled in the Heart; and because (the pores of the skin, being possessed by the same matter, thrust forth towards the circumference of the Body) the vaporous *Effluvia* are restrained within, which do more shake, and make hot the Blood; that heat persists still in the Blood, until that Fermentative matter being wholly burnt out, and together with the adust recrements, remaining after the burning, being fully brought under, and subtilised, and involved with the *Serum*, insensibly evaporates by sweat, or transpiration.

Thirdly, These things being premised, it will not be hard to shew the reasons and causes of the intermission, as also of the set periods, *viz.* the intermission follows, because all the Morbific matter is dispersed in one fit, and so till new be substituted, there is a necessity that a remission follow. But new matter begins to be begot, of which the last fit failed, to wit, the mass of Blood being but now emptied, receives the nourishing Juice, and perverts it (as before) by reason of its defect of due making of Blood, and of Concoction, into a Fermentative matter; but its little plenty, stirs up little or no trouble,

trouble, or Fermentation; but when the Blood is filled to a swelling up, it presently ferments, and is in Flux, even as when new Beer, or new Wine, shut up a long while in a Vessel, at length, at a certain time, boils up, and leapes forth at the mouth of the Vessel.

But that the Fits, or Accessions, do for the most part come again, at set intervals of times, and that so certainly, that a Clock is not more exact; the reason is, because the nourishable Juice, is for the most part supplied from the Viscera, to the Blood flowing in the Vessels, in an equal measure and manner; for tho we do not daily take exactly, so much meat and drink in weight and dimension, yet, because we for the most part eat at set hours, for the satisfying the Appetite, from the things eaten, and the mass of the Chyme heaped up in the Bowels, an equal portion of the nutritious Juice is conveyed to the Blood through the Milky Vessels: wherefore, if at such hours, so much of the nutritious humor is poured into the Blood, which increasing to a fulness, and swelling up, it brings on the fit that day: certainly, this being finished; in the space of the same time, sufficient matter is laid up, for the following fit: But if errors in feeding be committed, and that the sick indulging their Appetite, eat more plentifully or inordinately, the approach of the fit anticipates the wonted hour, by reason of the Bloods being filled sooner with the Feaverish matter; if that the sick are abstemious, and more sparingly take their Food, the intermission is drawn out longer.

If it be yet asked, wherefore the periods of intermitting Feavers, be not of one kind, and of the same distance, but that some repeat or come again daily, others on the third or fourth day? The cause is the diverse constitution of the Blood, to wit, whereby it is perverted from its due temper; now into a sourish, now into an acid or sharp, or into an austere or harsh disposition. By reason of the diverse evil constitution of this, the alible Juice, being fresh carried, departs more or less from maturation, and is perverted into matter, apt sooner or later to ferment. When the Blood has acquired a sour, hot, and bilious disposition, I suppose that some part of the nourishing Juice is ripened into perfect humor, and is assimilated with the Blood, and so goes into Food, to be carried to the solid parts, and is affixed to them; but the other part of it, from the Blood being too much cocted, and depraved, is changed into a Feaverish matter, and supposing, that half of the nutritious Juice is after this manner perverted; in double the time, in which it is said to have a full Concoction in our Body, (that is, after eight and forty hours) this kind of Fermentative matter, rises to a plenitude, and turgescency, and then induces the fit of a Tertian Feaver. If that, by reason of the austere, and pontic nature of the degenerated Blood, (in which a fixed Salt, with an Earthy *Fæces* is exalted too much) and therefore apt to ferment more slowly, only a third part of the nutritious Juice is corrupted, then in three times the space of the aforesaid time, the fit is induced; that is, after seventy two hours, in which, the period of a Quartan, is wont to be concluded. But, if by reason of a greater infection of the Blood, almost the whole supplement of the nutritious Juice is perverted into a Feaverish matter; then in the space of that time, in which the plenary coction ought to be absolved in the Vessels and habit of the Body, (that is after twenty four hours) this matter arises up to the motion of turgescency, and brings on the Quotidian fit. And hence it comes to pass, that in a Quartan Feaver, strength and courage do not presently fail, whilst in a Tertian, the sick are wont to become more weak; but in a Quotidian Feaver, they are sooner brought into languishing, and greatest weakness: to wit, in each, as more or less of the nutritious Juice goes into the Food of the Disease, so much also is drawn away, from the strength and firmness of the Body. But more fully of these, when we treat of the several kinds of Intermittent Feavers, and the Causes of them.

Against the equal Circuits of these Feavers, it is argued: that for the most part, the fits do anticipate the set time of the day, by the space of some hours, and sometimes also come after it. But in truth, this objection is taken away, if the times of intermission be computed, not by days, but by hours; for so the intervals which but now seemed to be now sooner, now longer protracted, will appear for the most part equal, by this Rule; forasmuch as in respect of the day, it is said a Tertian Feaver, sometimes prevents the wonted time of its accession, two, three, or more hours, or comes after it; in the mean time, every circuit exactly repeats or comes again, every time, after so many hours. Wherefore the chief differences of Intermittent Feavers, consist in this only, that the time of the accession in one Feaver, comes more
swiftly,

swiftly, and in another more slowly, *viz.* now at twenty four hours distance, now at thirty four, now at seventy or the like.

From what hath been said, (unless I am deceived) it clearly appears, what the Effervescency of the Blood is, which constitutes the fit of an Intermitting Feaver, from whence the fore-runners of cold and shaking, and lastly, what may be the reason of the intermission, and of the set periods. But that these, and many other appearances of this distemper, depend upon the evil disposition of the Blood, and because of the depravation of the nutritious Juice, and not from humor, lurking in some mine, will yet more manifestly appear, from the collation of the signs and symptoms, which are to be met with, worthy of note, in this distemper: then secondly, from the Procatartic, or more remote causes being truly weighed, which are wont to induce this distemper: and thirdly, and lastly, from the ways of the Crisis, and Cures, by which this Disease, either ceases of its own accord, or is driven away, by the help of Medicines.

First, Among the Signs, the Pulse and Urine, deserve the chief consideration: The Pulse, the cold fit coming on, is very rare, and low, which clearly argues, the Heat, and Vital Spirits in the Blood, to be as it were overwhelmed, by some crude matter, not easily combustible; just as a fire inkindled on the Hearth, and then covered with green wood, glows very slowly, and flames forth little, which afterwards, the crude humor being blown away, breaks forth into an open and very strong flame: so also, the Blood, the crude matter, which is in Flux, being something overcome, or dispersed, is very much inkindled; and what remains in the Blood is burnt up, when fermenting with the Particles of it, and induces a most violent heat, with thirst; wherefore the Blood growing impetuously hot, is urged with a vehement, and most swift Pulse: otherwise, it being too much heaped together in the Heart might cause the danger of choaking.

As to the Urine; that is imbued (especially in a Tertian Feaver) with a deep colour, and as it were inflamed, also when the Contents are wanting; which seems to denote a scorching of the Blood, and too adust temper: moreover, in this Distemper, different from others, the Urine, for the most part is ill, when the Patient is pretty well, and on the contrary; forasmuch as all the time of the intermission, it is at a great distance from its natural state, it becomes filled with a red colour, and thick, being exposed to the cold, and lays down a plentiful sediment, like to Bole-Armonick; which is of necessity to be so done, because in the whole interval of the remission, the Feaverish matter is circulated with the Blood, and there rises to maturity, with a secret increase. But in the middle of the fit, when the heat, and burning are at the greatest, the Urine is laudable, and comes more near to the natural, *viz.* the Fermentative matter, being sent to the Circumference of the Body.

The symptoms preceding the fit, confirm the same thing; for many hours before the fit begins, a perturbation of the humors, and blood, is perceived; an Headach, Vertigo, sparkling of the Eyes, unquiet Sleep, &c. which plainly shew, the Blood first infected with the Fermenting matter, and the assault of the fit to be only so long deferred, until the mass of the Blood is filled to a swelling up, with the same kind of matter: The fore-runners of the approach of the fit are, now a paleness at the ends of the Fingers, or Toes, or in the Nails, sometimes a Convulsion, or numbness; now a coldness, and pain in the Loins and Thighs, and sometimes a shivering and trembling invade the whole Body, which clearly shew, the Blood in the Arteries and Veins, and also the thin Liquor in the Nervous parts, first to conceive the motion of Fermentation, and this Effervescency, not to be excited from any other fire-place, or mine. If it be objected, that the sick are most often infected with Vomiting, about the time of the fit; from whence it may seem to be concluded, that the chiefest hurtful matter is established in the Ventricle, and in the first passages, especially, when this distemper is chiefly cured, by the timely taking of a Vomit; I confess, very great Vomiting are sometimes stirred up, in the fit of an intermitting Feaver; but this more often happens, because in the Feaverish shivering, the membranes of the whole Body are pulled; wherefore the Ventricle also, as it is a very Nervous part, is distempered with a Convulsion, and having from thence contracted a Spasm, casts forth upwards whatsoever lurks in its bosom. Besides, if that the Choler-bearing Vessels, swell up with Bile or Choler, by the same Convulsion also of the Viscera, the Bile is pressed forth into the Duodenum by the Galick passage, and is emptied into the Ventricle, and there, by its fierceness, provokes yet to more cruel Vomiting, wherefore for the most part, the

the vomiting which is excited for this reason, follows the shaking only. But that the Choler was not in the Stomach before the fit troubled it, but only pressed forth from the Choleduct passage, by the Spasm and Convulsive motions of the Viscera, and poured forth into the Ventricle, appears from hence, because if a Vomit be given in the midst of the interval, between the two fits, little or nothing of bilous matter will be drawn forth; besides, this bitter humor is of that fierceness, that it cannot be long contained in the Ventricle, but presently it will procure the pain of the Heart, and Vomiting. Besides this sort of Vomiting, excited in the shaking fit, sometimes a Vomiting is provoked in the midst of the burning fit, or in the sweat, the cause of which is, the redundancy of the bilious humor in the Blood; of which if there be greater plenty, than what diluted with *Serum* may be sent forth by Sweat, a great part of it, whilst the Blood is circulated about the crevices of the Liver, is laid aside in the Choleduct Vessels; which, when being filled to a distention, exonerate themselves, and send away the Choler to the Intestines and Ventricle, and there a Convulsion being presently stirred up, sometimes Vomiting is provoked, and sometimes the Belly becomes loose, and the Stools liquid. In this Year 1657. I observed very many affected after this manner, for when after an hot and dry Summer, about the middle of Autumn, an Intermitting Feaver generally raged, the sick were wont suddenly to grow very ill, in the middle of their hot fit, and sometimes also in their sweating, and the Sweat being struck in, to be taken with Swooning; but shortly after, when a Choleric Vomiting followed, they were eased.

Not only the signs and symptoms, but the Procatartic or more remote Causes of this Disease, clearly indicate, that it takes its rise from the temper of the Blood being changed: because Intermitting Feavers, are most frequent in the season, and places, in which the Blood receives the greatest alteration from the Air, *viz.* either in the Spring, when the vernal heat shutting out the Winters cold, causes the Blood, before benumbed, and apt to be more slowly moved, to begin to flourish, and luxuriate in the Vessels, and from thence, to get a bilous and hot temper: or in the Autumn, when the Blood being torried, or roasted by the Summers heat, and therefore its Spirits very much depressed, and Salt and Sulphur exalted, acquires now a sharp and Choleric, now a binding and austere disposition: wherefore, at this season, Feavers, now Tertian, now Quartan, are frequent; besides, in some places, there is that constitution of the Heaven, that on all men whatsoever, there comes either a Tertian or (more frequently) a Quartan Feaver; although in the first offices, where the Mine of the Disease is commonly believed to be lodged, there be no congestion of humors, by reason of an ill manner of living, or sickly disposition. Yea, they most easily fall into this Disease, who have their inwards firm and strong, and who abound with a lively heat: on the contrary, those who by reason of a weak Concoction, heap up Crudities in the first passages continually, that they are prone to the Dropsie, or Cachexia, remain free, for the most part, from this Distemper; to wit, the Blood being made more watery, (like Wine degenerated into a tasteless substance) is altogether unapt to be fermented.

No less, doth the Cure of Intermitting Feavers seem to prove this our Assertion, whether it be Natural and Critical, or Artificial, and performed by the help of Medicines. As to the first, Intermitting Feavers are wont to be terminated, after a two-fold manner. The first is, when from the fits themselves, the temper of the Blood is altered, and oft times is reduced into its Natural disposition. For when in every coming of the fit, very much of Sulphur, and adust Salt is burnt out, and exhaled by Sweat, the Liquor of the Blood, by that means, becomes more temperate, and less torrid: wherefore, oftentimes this Disease is cured, at six or seven periods, and of its own accord ceases: but if it be longer protracted, and that the Blood being somewhat changed, from the sharp and bilous temper, or disposition, is not restored to its Natural temper, sometimes it degenerates into an Acid, Watery, and also Pontic or saltish temper, from whence a long Tertian Feaver passes into a Quotidian, or a Quartan; also oftentimes, because the Blood is greatly depraved, by the long continuance of this Feaver, the Jaundies, or the Scurvy, or the Cachexia follow. The other manner, whereby this Disease is terminated, is, when the change of the Air, or the Country, brings a notable alteration of the Blood: for so Feavers begun at the times of the Equinoxes, are ended about the time of the Solstices; also the sick, traveling into another Region, often grow well.

As to the cure of it, by the Institutions of the Medicines, it uses to be done two ways, *viz.* Empirically, and Dogmatically; and in this Disease, Empirical remedies, fought from Quack-salvers, and old Women, are more esteemed, and oftentimes do more than the prescriptions of Physicians, administered after the exact method of curing.

Empirical Remedies, which are said to cure Intermitting Feavers or Agues, are of that sort, which drive away the approaching Fit, without any Evacuation: and are either taken inwardly, or are outwardly applyed; where the Pulses chiefly beat, *viz.* For the most part, they are bound either to the region of the heart, or to the hand-wrists, or to the soles of the feet; these sometimes are so commonly known to help, that some have warranted the sudden cure of this Disease, by these Remedies, under the pain of some Forfeiture: Wherefore it is worth our inquiry, how these operate, and by what way or means they stop the Feaverish accessions. It is clear, First, that those which are outwardly applyed, do immediatly impart force, and action to the Blood, and Spirits; and when they drive away the Fit, by preventing, without the Evacuation of humor, or any matter of necessity, the reason of this effect consists only in this, that by the use of these sort of Medicines, the turgescency or swelling up of the Blood, with the Feaverish matter, and Fermentation are stop'd; to wit, from the Medicine tyed about the Body, certain little Bodys, or Effluvia are communicated to the Blood, which do very much fix, and bind together the particles of it, or also, as it were precipitate them, by fusing and shaking them; and by either way, the spontaneous growing hot of the Blood, is hindred: as when cold water is put into a boiling Pot, or as when Vinegar, or Alum is flung into new and working Beer, presently Fermentation ceases, and the Liquor acquires a new tast, and consistency, whereby it becomes fit to be drunk, as if it had been kept to ripen a long time. But that these Ague-stoppers do work after this manner, it is plainly seen, because those which are of principal note, do excell in a Styptic, and binding force, or else with a precipitating virtue; hence Sea-salt, Nitre, Sal-gemmæ, the Juice of Plantan, Shepherds-burse, any binding Herbs pounded with Vinegar, and the like, bound to the wrists; the root of Yarrow, Tormentile, also Campher hung about the neck, are said to take away this Disease: yea, those also which are taken inwardly, are of the same rank; The Juice of Plantan, Red-rose water, Alum, for that they fix, and constrain the Blood, a decoction of Piper, Sal Armoniac, or of Wormwood, Spirit of Vitriol, also a sudden passion of anger, or fear, forasmuch as they precipitate the Blood, by fusing and shaking it, do oftentimes hinder the Agues approach: even as the Concussion, and shaking much, any Liquour, or the infusion of astringent things into it, hinder its spontaneous Effervescency and rage. It is usual with some Empiricks, for the cure of Agues, to tie a little knot in a Linnen rag, or a piece of Paper roled up, so strickly to the wrists, pressing hard upon the beating of the Pulse, that the circulation of the Blood is somewhat hindred, and by this means, the Aguish fit coming on, is driven away. Very many by this way, I have none to be most certainly cured of a tedious sickness; the reason of which seems to be, that whilst the Blood is hindred from its motion in any part, it grows more tumultuous in the other parts; and so, by this perturbation, stirred up in the whole Blood, the spontaneous Effervescency of the Liquor, being about to follow, is hindred. But that the Fit, by this, or any other means, being once hindred, does not afterwards easily return, the reason is; Because, if this Feaverish, and depraved matter, be contained longer in the Blood, it is afterwards cocted, and in some measure ripened: and therefore the Blood does not (as before) altogether pervert, either this, or the provision coming to it anew, but begins to digest and assimilate it: besides, when the Fit is once stop'd, its custom is broke, by the instinct of which alone, Nature oftentimes repeats those her Errors: for, as; when it has once made a fault, it is wont more readily to do ill after the same way; so when it once omits its fault, it more easily accustoms it self to do better.

The dogmatical cure, is instituted for the most part, by Vomitory and Purging Medicines, also with the letting of Blood; with which the sick are miserably tormented, and the Disease seldom profligated or driven away; that deservedly, this Distemper is called the shame of Physicians; but Tertian Feavers are sometimes carried away by a Vomit given just before the coming of the Fit, which indeed happens (as I think) for the reason before mentioned. For I have said, That the cause of a Tertian Fever, is an evil disposition of the Blood, whereby it passes into a sour and bilous Nature; and therefore it doth not rightly assimilate the nutritious Juice brought to it, but changes
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it into a Fermentative matter; wherefore, if the Bile or Choler be copiously drawn forth of the Blood, that Cholerick and hot intemperance is very much taken away, and that Fermentative power ceases of it self, But Emetick Medicines do chiefly perform this, for if they operate strongly, a Convulsion is not only brought to the bottom of the Ventricle, but also the *Duodenum*, with an inverse motion, is drawn together towards the Pylorus, and the Choler by a continual thrusting forward, being squeezed forth from the Choleduct passage, is poured into the Ventricle, which is presently cast out by Vomit; which being copiously performed, the gallish bladder is almost emptied, and after that, it becomes a receptacle, that draws forth, and separates the bilous humor, or the particles of adust Sulphur and Salt plentifully poured into the Blood; the next Fit sometimes is by this means prevented, not because the mine of the Disease is extirpated by Vomit, but because an Evacuation and motion is excited, contrary to the Feaverish motion, and for that reason, the spontaneous Effervescency of the Blood is prevented. Also by this means, sometimes the Disease is taken away after the Fit, because this way, the Blood is fully cleared from the bilous humor. It is worthy observation, that in a Quartan Feaver, Vomits profit nothing, and seldom in a Tertian, unless administered presently at the beginning, whilst the Feaverish disposition is yet light, and not fully confirmed.

Concerning Intermitting Feavers in general, there yet remain some Irregulars of them, to be explicated, which vary from the wonted manner: for unless these unusual appearances be solved, this our Hypothesis will seem to be defective, and to halt in one part. First therefore, they are wont sometimes to lack the cold or shaking fit. This Intermitting Feaver is frequent in Autumn, whose fits are wont to exercise the sick, only with heat, and that most Violent, and in many they come with great Vomiting, but no Sweat or Cold; then after four or five periods, upon the coming on of the fit, the sick are wont to be chill, and presently after to quake, and in the declination to sweat: The reason of this was, because, from the very hot Summer, the Constitution of the Blood was become sharp, and very much burnt: Wherefore, the Particles of the crude Juice, being commixed with it, were presently terrified or made hot, and scorched; that they did not at first, (like new Beer) grow hot with an Acrimony, and then afterwards blaze forth; but a turgescency being stirred up, (like dry wood laid upon a fire) presently the whole took fire, and broke forth into flames; but afterwards, the Liquor of the Blood being fired by several fits, became less torrid, that the depraved Alible Juice was not presently torried, but passed into a Nitrous matter, and fermenting with a sharpness, which at first swelling up, induced the sense of cold to the whole Body. When the cold fit was begun, for the most part Sweat concluded it: which indeed hapned, because the Blood being made more watery, is more easily resolved into vapour, with the Feaverish matter, even as a watery Liquor is more easily drawn forth by distillation, than what is Oily, or of a more thick consistency.

It often happens, in the declination of this Disease, when the fits begin to lessen, that the sense of cold and shaking, by little and little are diminished, and at length vanish, and the fit only troubles the sick, with a light burning: The reason of which is, because at this time, the Blood being somewhat restored, towards its natural state, begins to concoct and ripen the crude juice; so that a great part of it is assimilated: but some Excrements, being heaped together in the Blood, bring forth as yet a light burning: but when the Feaverish Particles, do not participate of the Nitrous Acrimony, the Fermentation of the Blood is induced without any shivering, by which, what was extraneous burns forth, is either subdued, or carried forth of doors. Sometimes also, in the declination of this Disease, the fits appear without any burning, only with a light cold: The reason of which is, because the Morbific matter, being rather Nitrous, than Sulphureous, when it is in Flux, does somewhat blunt the Natural Heat; and by that means is dissipated, and vanishes, without any great deflagration.

There is yet a great doubt concerning the intervals of the periods, which sometimes seem to be double in the same Feaver, that the first Accession answers to the third, and either perhaps comes in the morning; and again the second to the fourth, and both happen in the Evening; and so forward: wherefore, the Feaver bearing this figure, is wont to be named a double Tertian, or Quartan, of which it doth not easily appear, how they should be done, if the fits depend upon the evil disposition of the Blood, and from thence on a Congestion to a Turgescency of the depraved Nourishing Juice: for which cause, they commonly affirm, that this double figure is

stirred up, or draws its original from a double Nest, or Mine; but to me it seems most likely, that in this case, sometimes it happens for the Feaver to be simple, and of one kind, also its types or figures to be alike, and all congruous one to another, but the error to arise, because the interstitia of the periods, are not computed by hours, but days: For when as, the beginnings of the fits are distant one from another, not exactly twenty four hours, but either sixteen, or thirty hours, in a Quotidian; and in a Tertian, not forty eight, but forty, or fifty six, more or less, or thereabouts; it comes to pass, that every other fits, happen before, and the others after Noon. To which also may be added, that the different manner of eating, which the sick use, very often produces great inequalities of figures: that sometimes the fit is redoubled twice in a day, as I have often observed in Cachectical men, or full of ill humors, and living disorderly: but it doth not seldom happen, that Intermitting Feavers, repeat fits, which do neither observe the same distance, nor bear altogether the figure of the same mode. I have many times observed in a Quartan Feaver, that besides the set comings or Accessions, returning on the fourth day, about the same hour; some wandering and uncertain fits, did infest the sick; that sometimes on the day preceeding, the wonted fit, sometimes on that following it, another fit (tho lighter) was excited anew, with shivering, Heat, and Sweat, exactly like the figure of an Intermitting Feaver; and nevertheless, the primary Accession returned at its accustomed time. This for the most part, is wont to happen, either from diet evilly instituted, chiefly from surfeit, and drinking of Wine; or else from Medicines wrongfully administered: The reason of which (unless I am deceived) consists in this. The mass of Blood, being wont to be filled to a swelling up, with the Fermentative matter, at a set time, often, by reason of some errors in eating and drinking, heaps up more matter, than can be easily dissipated in one fit; and when it unequally Cooks the same Fermentative matter, it often happens, that it first shakes off its superfluous, or more thin part, as it were by a certain skirmish, in a more light fit, but dispels the more thick, (after the primary Accession) as yet remaining in the Blood, by a Feaverish Fermentation arising anew. And when the fits, in an Intermitting Feaver, redouble after this manner, either become more remiss, for that the same matter in either, is only divided; and eventilated by two accessions. Besides, when this Fermentative matter, or Nutritious Juice, depraved in its circulation, is continued, partly in the Arteries and Veins, with the Blood, and partly in the Nervous stock, and solid parts, it may happen, that both humors do not ferment at once, but a great part of one may be dispersed in one fit, and then a great part of the other, in another fit.

C H A P. IV.

Of the kinds of Intermittent Fevers, and first of a Tertian.

WE shall easily accommodate to our Hypothesis, delivered in the former Chapter, concerning the nature and beginning of Intermittent Fevers, all the Phænomena which belong to it, and the reasons of them. But as those which are of this sort, do not observe the same space of Intermission, or of return, and their figures, as to the appearances of their signs and symptoms, do not altogether happen after the same manner; therefore according to the diversities of these, and especially from the distance of the fits, the various species and differences of Intermittent Fevers, are assigned. The chiefest division of them is, into Tertian, Quotidian, and Quartan: We shall here remark the chief things worthy of note concerning each of them.

It is called a Tertian Fever, not which is accomplished at the distance of three days; but inclusively from the day in which one Fit begins, from thence the other returns on the third. In the mean time, if the Fits be sometimes longer, *viz.* protracted almost to twenty four hours, and the Remissions anticipated also by their accessions, or comings of the Fits, the space is oftentimes less by a night and a day. This Disease is commonly distinguished into exquisite and spurious; The exquisite or exact Tertian Fever is, which begins with a vehement shaking, to which succeeds a sharp and biting heat, which goes off in sweat, and its Fit is finished in twelve hours, and that the perfect intermission follows; In the spurious or bastard Tertian, the cold and heat are more remiss, but the Fit is often extended beyond twelve hours, yea often to eighteen or twenty. These differ as to the various disposition of the Blood, which is in the former more torrid and sharp; therefore perverts the alible Juice from Crudity, towards an adustion, wherefore a more vehement Effervescency is stirred up; but as the matter more equally burns forth, it is sooner finished. In the latter, besides the adustion, the Blood abounds with too much serous humidity, wherefore, the nourishing Juice degenerates into a Crude matter, and therefore less apt to be overcome, and to burn forth; wherefore, its Fit is gentler, and more unequal, but is not finished but in a longer space.

The Essence therefore of a Tertian Fever consists in this; That the Blood (like Beer brew'd with too high dry'd Mault) being too sharp, and torrid, does not rightly subdue, and ripen the alible Juice, which is taken in from crude things eaten, but very much perverts it into a nitrous-sulphurous matter; with which, when the mass of Blood is filled to a swelling up, like new Beer stop'd up in Bottles, it conceives an heat: From the flux of this nitrous matter, which blunts the heat, and vital spirits, and pulls the nervous parts, first the cold, with shaking is excited; then the vital spirit getting strength again, this matter growing hot in the Blood, begins to be subdued, and inkindled in the heart; from whose deflagration, an intense heat is diffused thorough the whole body; then its reliques being separated, and involved with *serum*, are sent away by sweat.

This torrid Constitution of the Blood, consists in this, That 'tis impregnated more than it ought, with particles of Sulphur and Salt; wherefore, the Procatartick causes, which dispose to this Disease, are an hot and bilious temperament, a youthful age, hot dyet, as an immoderate use of Wine and spiced Meats, but especially in the Spring, and autumnal seasons of the year, when the Blood (as all vegetables) is apt to flower, and to ferment of its own accord. By reason of these occasions, the liquor of the Blood, is want to be thorowly roasted, and to be changed into a cholerick temper: and when it departs from its natural Disposition, so much, that it perverts the nutritious Juice, into a matter plainly Fermentative, the beginning of this Fever is induced; which sometimes happens from this intemperance, being leasurely increased and brought to the height; but more frequently, an evident cause raises up this disposition
into

into act, and we ascribe the origine of this Disease to some notable Accident. Wherefore, lying on the Ground, or taking cold after sweating, or transpiration being any ways hindred; also a Surfit, or a perturbation of the Stomach, from any thing inordinately eaten; and lastly, What things soever stir up an immoderate heat in the Blood, bring the lurking disposition of this Disease into act: for that, from every such occasion, the nutritious Juice, being heaped in the Blood, and somewhat depraved, conceives a Flux, and departing from the rest of the Blood, ferments with a nitrous sharpness, then being inkindled and shaken by the Spirit, and vital heat, it induces the Fit, with a very strong burning.

A Tertian Feaver, is wont to be more frequent in the Spring, at which time, the Blood is livelier and richer, and therefore more fitted for this kind of Feaverish distemper. If this Feaver being taken, be ended within a moderate time, tis commonly said to be a Medicine, rather than a Disease; which is partly true, because, by this means, the impurities of the Blood burn out, the obstructions of the Viscera are discharged, and in truth the whole body is ventilated, so that 'tis wholly freed from every Excrementitious matter, and the seminary of growing Diseases. But if this Disease be long protracted, it becomes the cause of many Sicknesses, and of a long want of Health. For from hence the mass of the Blood is very much deprived of the vital Spirit, and (like Wine too much fermented) in a manner grows lifeless: wherefore the Jaundice, Scurvy, or Cachexia, follow this Feaver, being long ere it be cured. For by its frequent Fits, the vital Spirit very much evaporates, and because it is but little restored by things eaten, the Blood therefore becomes weaker, and almost without life: In the mean time, the particles of Salt, and Sulphur, are carried forth more, and exalted; from whence, the Blood is made sharp, and salt, and so more unfit for Circulation and Transpiration.

Moreover, This Disease being long protracted, oftentimes changes its Figure, and from a Tertian Feaver, becomes either a Quotidian, or sometimes a Quartan: then sometimes from either, it returns into a Tertian. The reason of this is, the disposition of the Blood being variously changed: which at first being sharp, and bilous, had perverted the nutritious Juice, by that means, that it arise to a fulness of swelling up on the third day; afterwards, by the frequent Deflagration, becoming less sharp, or in truth more waterish, it grows far weaker as to its Constitution, so that it doth very little, or not at all assimilate the nourishable humor, and ripen it, and by that means, the increase of the Fermentative matter is made sooner, and the Fits return daily: or else, the Blood from a sharp and bilous intemperance, (the constitution of the Heaven, or the year, bringing on this alteration) is changed into an austere, or saltish, and therefore more slowly perverts the nourishing Juice, and the increase of the Feaverish matter, gathering together more slowly, it doth not conceive the Fits till on the fourth day: but if either, by the means of Physick or Dyet, the temper of the Blood is reduced from either Dyscrasie, towards a bilous, the periods also are altered, and they resume the figure of a Tertian.

Certain symptoms are wont to come upon a Tertian Feaver, which are commonly esteemed for the Crises of this Disease; and in truth sometimes, these appearing, the Distemper either clearly ceases, or begins to abate of its wonted fierceness. But these kind of signs, are chiefly these three, *viz.* The Erysipelas, or an Eruption of pimples in the Lips, the yellow Jaundice, and an Inflammation, or swelling suddenly excited, in this or that part of the body: very often there happens after three or four Fits to the Sick, little ulcers, with a crusty scab, to break forth about the Lips, and altho there be no coming away of any matter, in all the body beside, yet from hence they presage, that the Feaver is about to depart, which sometimes the event proves true. But indeed sometimes, I have observed, that the hoped for effect has not succeeded, but that the Feaver pertinaciously, and for a long while hath afflicted them, when their Lips have been broken out. But as to what respects this Symptom, it seems to arise, for that the Blood having got a more free Diaphoresis, it not only thrusts forth adours, the more thin, and smokie recrements, but also the more thick; and when the same, in other parts more easily exhale thorow the more open Pores, they stick in their passage about the Lips, by reason of the skin being more strictly bound together; and because the vaporous matter, abounds in particles of adust Salt, and Sulphur, being fixed in the skin, it there hinders Circulation, and therefore induces Pusiles, and little Ulcers; perhaps the more hot breath, which is breathed forth from the mouth, and nostrils, may contribute something to this Distemper, forasmuch as it scorches, and burns the
Blood,

Blood, and Juices flowing thither : wherefore, it may be said, That this eruption of Pusles, denotes only a more full Diaphoresis in the whole, by which, the more thick; as well as the thin recrements of the adust Blood, evaporate forth of doors. For I have known in some, from a Tertian Fever, little welks like the small Pox to break out in their whole body, that if by this more plentiful Ventilation, as it were a purging, the Blood be so freed, that it recovers its pristine disposition, the Fever is cured : But if (as sometimes it happens) some recrements, tho more thick, break forth, yet others stay within, and still cherish the Feaverish disposition, those little Ulcers, argue only a greater taint of the Blood, and pertinacy of the Disease, therefore it may be observed, when that scabs break out in the lips, if the Fever does not presently abate, that it will be more grievous, and tedious for the future.

Sometimes the yellow Jaundice comes upon a Tertian Fever, and cures it ; (which *Hippocrates* has also taken notice of) the reason of which is, because, when the Blood has got a sharp or bilious disposition ; that therefore it had perverted the alible Juice, and from thence had heaped together excrementitious matter, it is oftentimes freed by that Dyscrasie, when by a sudden Secretion, the recrements of adust Salt and Sulphur, are more plentifully purged forth. This the Choleduct vessels being irritated by Physick, or of their own accord, and so pouring out plentifully the Bile, from the Blood, do often perform : because Vomiting, Purging, and especially a Diarrhea or Lask, very much conduce to the cure of this Disease, yea sometimes, the Blood it self, putting forth of its own accord, thrusts forth the bilious recrements, as its off-scourings, and in the circulating puts them forth in the skin, and so inducing the yellow Jaundice, cures this Fever.

When an Inflammation, (as sometimes tis wont) comes upon this Distemper, the Ague is commonly said to fall down into the part distempered with the Tumor. But that by such a breaking forth, this Disease is cured, 'tis no wonder ; because the Blood by this means continually lays aside out of his bosom, the provision of the degenerate nutritious Juice, and transfers it to the distempered part ; and therefore, the degenerate and fermentative matter in the mass of Blood, does not easily arise to a fulness of swelling up : wherefore, the Belly being perpetually loose, hath by degrees helped some, for that the Blood by this means, readily casts forth its burthen, now growing low, and not having a more full increase yielded to it : sometimes also, a Deafness suddenly arising, the Tertian Fever has presently ceased, to wit, by reason of a continual translation of the Feaverish matter, from the bosom of the Blood, into the head.

If that the Tertian Fever, within a short time, neither by the free accord of Nature, declines by degrees, that it doth clearly cease within seven or ten periods, nor is cured by any of the aforesaid means, nor is removed by the help of Medicine, but that after ten or twelve Fits, the sick are still grievously afflicted, it will be a very hard task to cure it : because the Blood, from the continual heaping of the Feaverish matter, and by the frequent burnings, becomes at length so depraved, that it concocts nothing truly for the nourishment of the Body, and for the sustaining its strength ; neither is it able to shake thorowly out of its bosom, the impurities and excrements, whereby the Disease may make a Crisis or separation, but in truth, the same growing in strength every day, the Blood, besides its Dyscrasie or evil disposition, begins to be hurt somewhat in its mixture ; wherefore, more frequent Fits infest them, nor does a perfect Remission come between, but that the sick being very weak and languishing, are almost continually Feaverish, with thirst and heat : when it is come to this pass, unless they are succour'd by remedies from Art, or that the change of the Place, and Air, bring timely help, this Disease often ends in death.

As to its cure : the method of healing is commonly directed to this one scope, to wit, that the mine of the Disease may be extirpated, and that the Feaverish matter may be eradicated out of our Body, without any cherish remaining; or fear of relapsing ; wherefore, Vomits, and Purges are diligently Instituted, which when profiting nothing to the cure, but that the Patients strength is very much broken, the sick are left by the Physicians, and the business is wholly committed to Nature. The Intentions (as it seems to me) ought to be of this sort : First, a restitution of the Blood, to its natural Temper. Secondly, a prevention of the depravation of the nourishing Juice, as much as may be. Thirdly, an Inhibition of the Feaverish Fermentation, that the Fit may not be excited. And these Indications take place, not only in a Tertian Fever, but in any other intermittent Fever besides : which yet are to be performed,

performed, not by the same ways and remedies, but by several, according to the diversity of the Disease, of the condition of the sick, and of the symptoms chiefly urging. However in the curing of this Disease, there is more to be attributed to Nature, and to a good order of Dyet, or way of Living, than to Physick.

1. Concerning the first Intention, to wit, that the Blood may be reduced to its natural Temper, Vomits, letting of Blood, and Purging are of great use: especially, if they be celebrated in the beginning of the Disease. *Vomitories* help, both for that they Purge the Ventricle, that the first Concoction may be better performed, and by that means the nourishing Chyme may be more purely supplied, for matter of the Blood; but chiefly, for that by plentifully pressing forth the Bile, from the Choleduct passage, they empty the Gallish bag, as by that means, the Bile is poured forth more full from the mass of Blood; and so the Blood is purified, from the recrements of adust Salt and Sulphur. The opening of a Vein, cools and ventilates the Blood, as by that means, tis less torried, or scorched, and is circulated more freely in the Vessels, without danger of burning. Also Purging, plentifully draws forth, and by provoking expresses, or squeezes out, the Bile, from the gallish Vessels, and consequently from the mass of Blood. For this end, (to wit, the reduction of the Blood) Digestives bring help, the more temperate Vinegars, or Acetous things, forasmuch as they fuse, and alter the Blood, and do attemper its fervor. Sometimes also, the change of the Soil, and Air, notably amends the evil constitution of the Blood, before all other Remedies whatsoever.

The second Intention, is excellently performed, by Dyet, and an exact manner of living; which in this Disease ought to be slender and sparing: wherefore it is commonly said, Starving is the best Remedy for this Disease: and it appears by common experience, that by a more spare eating, the coming of the Ague fit, is very often prolonged, beyond its wonted Custom. There are especially two things to be observed, concerning Eating and Drinking: The first, that the food be slender, that nothing Sulphureous or Spirituous be given, for so the Conflagration of the Blood will be lessened; then secondly, that the Fit approaching, or urging, nothing of Aliment be taken, wherefore, in fasting the Fit is lighter, and sooner finished.

As to the third thing proposed; the Inhibition of the Feaverish Fit, is instituted by Remedies, which stay the Fermentation of the Blood. But tho this Remedy seems Empirical, and unmethodical, and very failable to Physicians, yet I have found these Feavers to be very often cured by this means, when Medicines have profited nothing: What they are, and by what means, without the suspicion of Witchcraft, they afford help, for the curing this Disease, is before noted. We shall here only advertise you, that the use of these is most profitable after Physick, and opening a Vein, if there be need of it; and unless these be rightly performed before-hand, those other rarely stop the Fit. But Vomiting, Purging, and breathing a Vein, unless they be presently celebrated after the beginning, yield little help, yea, more often are wont to hinder: For whilst the Blood is strong in vital spirit, its evil disposition, may with easie labour be corrected, or amended: wherefore, if the Bile, about the beginning, be copiously drawn forth, or the Blood eventilated, it is reduced to its natural Complexion; but afterwards, in the progress of this Disease (the Spirit being now very much exhausted, and the Salt and Sulphur too much exalted) if these kind of Evacuations be administered, they do more debilitate the disposition of the Blood: and therefore it is clear by observation, that the Tertian Feaver, is rarely or never cured, by these Remedies late administered, and often passes into a Quotidian. I my self have known some, in the Spring time, being strong in very good health, from a more strong Emetick taken for prevention sake, causing a violence by the Evacuation, to have presently fallen into a Tertian Feaver; and others, for some time cured of this Feaver, when they had taken a strong Purge, for the carrying away of the remains of the Feaverish matter, upon it to have fallen into a Relapse. It may be readily said, that the mine of the Disease, being before at quiet, was stirred up, and brought into Act, after this manner by the Medicine: But if you consider this thing rightly, it may rather be said, that from the strong Medicine, the disposition of the Blood was very much hurt, and when at first it was prone to a bilious Dyscrasie, that it hardly did assimilate the alible Juice, from this evident cause, it forthwith degenerated, that it wholly perverted the Nutriment, into a Fermentative matter, and so conceived the Feaverish disposition. It is a common opinion, that a Tertian Feaver can scarce be cured, without a Vomit, wherefore some Medicafters, are wont under the pretext of the necessity, to give to all whatsoever, labouring

labouring with this Disease (tho languishing and weak) an Emetick Medicine not without great danger of life : and those whom they judge wholly unfit for such a Medicine, they leave as not easily cureable to Nature. But (as I have often found the contrary by experience) this sort of practice is evilly instituted ; yea, I rather judge, for the curing of a Tertian Feaver. that Vomits are rarely or never to be required, unless in a strong Body, and very easily prone to Vomiting, and when the Ventricle happens to be burthened, with excrementitious matter, but instead of it, that a gentle Purge, by which the load of the humors may be pleasantly brought away, may be of better use : because, a Purge in this case, doth the same thing as a Vomit, to wit, it evacuates the choleduct Vessels, that the Bile, being plentifully exhausted from the Blood, the Feaverish Dyscrasie is mended. But when the gallick humor, being emptied forth into the Ventricle, is cast out upwards, from thence there is great hurt brought to the stomach, and a mighty perturbation excited in the whole Body : But if that humour be inticed downwards by a gentle Purge, it is sent forth of doors, without any trouble. Then, if to a gentle Purge, once or twice repeated, be added a very slender dyet, without flesh, it often answers the preservatory Indication, that there needs no other Remedies, for the taking away the cause of this Disease ; but that these being rightly performed, shall render beneficial those things, which being either inwardly taken, or outwardly applyed, stop the Feaverish accession. By this sort of plain and easie institution of Medicine, *viz.* A Purge of the infusion of Senna, and Rhubarb, a slender dyet, and a Febrifuge or Ague-resisting Topick, laid either to the wrists, or the breast, I have known very often, and in a very short time, Tertian Feavers cured, without the use of any other destroying Physick : yea, a thin dyet only, with Amulets timely administred, hath very happily cured Big-bellied women, and also very weak old men, whose strength could not bear Purging. I have so often made tryal of this method, with good success, that I doubt not, but that a Tertian Feaver, may as easily be cured, as any other Disease, if it be at the begining handled after this manner, *viz.* before the temper of the Blood be more hurt, by an evil manner of Dyet, or by Medicine untowardly administred. For the truth of this thing, I will relate this following History.

A certain noble young man, indued with a bilous Temper, had caught an intermitting Tertian Feaver ; upon the approach of the Fit, he Vomited forth much yellow and greenish Choler, then he was troubled most grievously, for many hours, with a great pain of the Heart, and most strong Heat and Thirst. On the day of the intermission there was taken from this person, with whom I was by chance, by my prescription, eight ounces of Blood, and in the afternoon was given an Emollient Glyster, he also used a most slender Dyet, (*viz.* only made of Barly) He took every night going to sleep, this Opiate, *viz.* Conserve of Roses vitriolated half a dram, of Diascordium a scruple, also every morning of the Salt of Wormwood a scruple, in a spoonful of the Juice of Orange : but when these did not succeed (for the Fit returned somewhat more remiss, but with cruel Vomiting, as at first) besides, for that this sick person, extremely abhor'd a Vomitory Medicine, (because not long before this, from a very gentle Emetick, he had Vomited almost thirty times, until being distempered with the Cramp, and Convulsions, he was brought into great weakness, with hazard of his life) therefore, the day following the aforesaid Fit, I gave him a Potion of an infusion of Senna, Rhubarb, and yellow Sanders, with Salt of Wormwood, in Spring-water, by which he was Purged ten times, with ease : In the morning after, and three hours before he expected the Fit, I put to his wrists an Ague-resisting Medicine, and took from him six ounces of Blood, by which means, he mist his Feaverish Fit, and then being again Purged after the same manuer, became perfectly well.

If that the Tertian Feaver, by reason of the evil Constitution of the sick, or because of errors in Dyet, or committed by Physick, hath more deeply rooted it self, that after a long sickness, the Fits still grow worse, and the sick extremely languish, with want of Strength, Thirst, and almost continual Heat, want of Appetite, wakeings, weak Pulse, high colour'd Urine, and very full of Contents, the Curatory method ought to be a little otherways instituted ; In this case, first it is to be endeavour'd, that the Dyscrasie of the Blood, may be taken away ; wherefore, the sick are to be fed, with slender Aliments only, as Barly broth, or Grewel, with opening Roots boiled in it, (flesh-broth being wholly laid aside) the Belly is to be kept loose, (if need be) with the use of Emollient Clysters ; besides (Purges being omitted) only digestive Medicines, which fuse the Blood, and bring away gently the serous Impurities by

Urine, also comforting Remedies, which corroborate the Viscera, and cherish the Spirits, are chiefly to be insisted on. To this end, Apozems are fitly to be prepared, of Herbs, and Roots gently Diuretic, also Opiats help very much, of temperate Conserves, with *Sal Nitre*, or the fixed Salt of Herbs, with shelly powders, and the Spirit of Vitriol mixed together. When the disposition of the Blood is somewhat mended, that the Urine is clearer, and less coloured, also sleep quieter, with a remission of thirst, and heat following; then may be profitably administered, Remedies to stop the Feaverish fit: wherefore Ague-resisting Amulets may be applyed to the Wrists or to the Soles of the Feet; also the powder of Peruvian Bark, or of something instead of it, or also of the Barks of the Ash-Tree, Tamarisk, or Gentian, with Salts mixed with them, and drunk in White-Wine: after the comings of the fits are taken away, and the sick being to get strength, and desire Food, and in some measure to digest it, gentle Purges may be of use: but let the sick still abstain, from a more plentiful Diet, or participating of Flesh, and they will shortly after recover perfect Health without any violent Purge or Phlebotomy.

CHAP. V.

Of the Quotidian Intermitting Feaver.

BEcause of its affinity to the Tertian Feaver, and likeness of fits, the Quotidian (or daily) Feaver comes next, *viz.* whose Accession is wont to return every day. It is the opinion of some, that this sort of Feaver, is only a double Tertian, and doth arise from a dispersed matter, having gotten a twofold Nest; to which I cannot assent, and I suppose its beginning is to be attributed, to a peculiar Dyscrasie of the Blood. In this the symptoms of cold and heat, are more remiss, but its fit is longer continued, and oftentimes it is wont to last eighteen or twenty hours: This Feaver for the most part follows a Tertian, for when the Vital Spirit is very much flown away, by the frequent deflagration of the Blood, and (the Feaverish disposition still remaining) the Blood is made weaker, it doth not concoct the nourishing Juice, or ripen it, but perverts almost the whole into a Fermentative matter; wherefore it comes sooner to its increase, and is gathered together to a plenitude of swelling up, within double the time, than at first. But because the congealed matter, participates equally of crudity, and adustion, therefore the heat of the burning is lesser, and more unequal, and (like green wood laid on the fire) slowly burns; for which reason the fit endures longer.

Sometimes it happens, that a Quotidian Feaver, doth arise without a Tertian going before, *viz.* when a Feaverish disposition, falls upon a Cacochymic Body, or full of evil humors, and stuffed with depraved Juices; for then the Blood, being poor in Spirits, perverts in a greater measure the nutritious Juice, and in a shorter time, gathers to a fulness of swelling up: But that which begins an every days Ague, oftentimes changes its figure, and becomes a Tertian; just as a Tertian, often goes into a Quotidian, because between these Feavers, and their causes, there is a great vicinity; and the constitution of the Blood being a little changed, it makes a transition from one to another. A Quotidian Intermitting Feaver, is not so easily cured as a Tertian: For whether it comes at first simple, or follows upon another Intermitting Feaver, it is still excited from a stronger cause, and argues a greater dyscrasie of the Blood, which will not presently give way to Remedies. But also, if this Feaver be of long continuance, or comes upon another Chronical Disease, it has most often adjoined to it, besides the taint of the Blood, the infirmities of the inwards: to wit, the Blood being spoiled, easily affixeth its impurities, by degrees heaped up, on the Viscera, whilst it passes through their Meanders: from hence it is, that in a Quotidian Feaver, the weight of the Ventricle, an extension of the Hypochondria, Obstructions, or Tumors, now of the Liver, now of the Spleen, or Mesentery, are joyned together; but these kind of distempers, are not the cause of the Feaver, (as is commonly believed) but only its product. Wherefore, in this Feaver, besides the simple method of

of Cure, which is shown in the Tertian, many other intentions or coindications, come under consideration: to wit, that the Ventricle be cleansed from its load of humors, the stuffings of the Inwards freed, Infirmities corroborated; and that together with these, the Dyscrasie of the Blood may be mended, and the Accessions of the Feaver may be restrained, must by all means be endeavoured; from whence, by reason of these kind of various intentions, we come to the Cure by a longer way: In this case, Vomits (if strength will bear them) are of benefit before all other Medicines: also Purges, whereby the assiduous supply of Excrementitious matter, may be drawn forth, are often to be repeated: Besides these, digestive Remedies, openers of Obstructions, such as restore the Ferment of the Viscera, and Blood, and correct their evil dispositions, are frequently to be administered. Wherefore, the fixed Salts of Herbs, and their Extracts, Acid Spirits of Minerals, and sometimes preparations of Steel, do very much help: concerning these main things, the task will be hard, when by reason of the manifold evil, many things are to be done together, yet by reason of the assiduity of the Feaverish fit, there is leisure for the sick to use few only. In Distempers so complicated, tho the reason of the method requires, the impediments to be first removed, and then to Cure the Disease, yet I have known, this kind of Feaver, beset with many other distempers, in a Body full of humors, often Cured, without method, and by an Empirical way; *viz.* after a light provision of the whole, Ague-resisting Remedies being outwardly applyed, have at first stopped the Feaverish fit, that then there was time, for the Curing the other distempers, and more happy occasions of healing were granted. I lately visited a Noble Lady, who being long indued with a Cachectical habit of Body, a month after her lying in, being weak and languishing, was taken with a quotidian Intermitting Feaver; after six or seven fits of it, her strength was so much cast down, that she could scarce rise out of, or sit up in her Bed; nor able to take never so little Food, tho very slender, but upon it, most grievous molestations were raised up, in her stomach; besides, the Region of her Ventricle, and left Hypochondrium, was wholly beset, with a hard shining tumor, and cruelly painful: by reason of her strength being mightily cast down, there was no place left for Evacuation, but the use of Clysters; also her Stomach, being very weak, loathed all other Remedies, unless very grateful, and only in a very small quantity. In this difficult case, circumscribed between narrow limits of Curing, I counselled these few things, to wit, that twice in a day, she should take this mixture, *viz.* The magisterial water of Earth-worms two Ounces, of Elixer Proprietatis twelve drops. Moreover, I ordered to be applyed to her Ventricle, a Fomentation, of the Leaves of Sea-Wormwood, Centaury, Southernwood, with the Roots of Gentian, boiled in White-Wine, in an open Vessel: also, that after the Fomentation, a Cake of Toasted-Bread, and dipped in the same Liquor, should be worn upon her Stomach; besides, Ague-resisting Medicines were ordered for her wrists; and with these Remedies only, she mist her Ague fit, on the third day, and remained free from it afterwards; then, by the use of Chalybeat Remedies, she became perfectly well, within a short time.

C H A P. VI.

Of a Quartan Fever.

IN a Quartan Fever, the period is longer than in the rest; to wit, which is extended to the fourth day inclusively; also its continuance uses to be longer, and its cure harder: because this Disease is protracted for many months, yea, oftentimes for years, and seldom, or scarce at all, is cured by Medicines.

The Fit, for the most part, begins with cold, and shaking, to which a very troublesome heat succeeds, but more remiss than in a Tertian: Sweat for the most part concludes the Fit. At the first coming of the Disease, the Fits are more grievous, and very infestous, and keep the sick in their Beds; yea, they make them lose their strength, and vigour of Body: But afterwards, the trouble is more easily born, so that the Fits are suffer'd out of Bed, and sometimes in a Journey, or being about any business. If it continue long, it induces the Scurvy, or Hypochondriac distemper, and involves men in an unhealthful condition.

The causes which dispose to this Disease, are first, the constitution of the Soil and Air, because this Distemper is proper to the fall of the Leaf, or Autumn, that you rarely find this Fever to begin, but about that time: also in some places, especially about the Sea-coasts, this uses to be general, or common to the Region, and to come upon those living there, or Strangers coming thither from elsewhere. A declining age, which is past its *acme* or height, also a melancholick Temper, and which, by reason of an ill manner of living, is obnoxious to the Hypochondriac Distemper, cause this: besides, long Fevers of another kind, and Chronical Diseases, often pass into a Quartan Fever.

According to these positions, and rightly weighed, it may be said, that a Quartan Fever, even as the other intermitting Fevers, depends upon a vitious disposition of the Blood; to wit, because the nutritious Juice, being by degrees delated into the Vessels, is perverted into a Fermentative matter; and the effervescency of this, heaped up even to a fulness of swelling over, constitutes the Fit of the Quartan Fever. But as in this Fever, there are some things, which are peculiar from the rest, we will inquire, what kind of Dyscrasie of the Blood it is in this Disease, distinct from the others, and by what means it excites, the very remarkable Symptoms.

The opinion, which is commonly had concerning this thing, is very far from truth: almost by the consent of all, the Essence and beginning of a Quartan Fever, is ascribed to a melancholick humour, heaped up somewhere in the first passages, and there periodically Putrifying. Instead of this, we affirm, that in this Disease, the Liquor of the Blood, doth pass from a sweet, spirituous, and balsamick, into an acid, and somewhat austere Nature, like Wine growing sowre: to wit, there is too great a want of Spirits, and the Terrestrial, or Tartareous part of the Blood, (which consists chiefly of Salt, and Earth) is too much exalted, and being carried forth into a Flux, induces the sourness of the mass of Blood. Even as Beer, being disturbed by Thunder, and infected with a troubled lee or dregs, grows sour. The Blood, after this manner degenerated, from its native disposition, doth not rightly dress the alible Juice, and assimilate it to it self, but perverts it into an extraneous matter; with which, when it is satished to a fulness, in the vessels, and the nervous parts are watered by the Juice, from thence arising, a Flux of this matter, and as it were a spontaneous effervency follows, by which indeed, the Feaverish Fit is induced, with shivering and heat, as is wont to be in a Tertian.

In a Quartan Fever, the periods have longer intervals, because, when the Dyscrasie of the Blood is become sourish, and therefore less violent and hot, it perverts the alible Juice without strife, or tumult: wherefore, it assimilates some of it, and the depravation of the rest, does not so far recede from its natural state, as in a Tertian, and from hence, its congestion to a plenitude, is made longer, and almost in another half of that time, in which a Tertian rises up to a Turgescency: And therefore, those taken with this Fever, are indifferently well, and are strong; which is a sign, that the nutritious Juice

Juice is less depraved; also, the Fits are made without cruel burning, because the nutritious humor, is perverted into a fermentative matter, without great adustion.

But why this Disease is so hard to be cured, and so pertinaciously infects the sick, the cause is, the melancholic constitution of the Blood, which is not easily to be taken away, and yields almost to no Remedies. The cholerick disposition of the Blood, is mended by the frequent Deflagration, and ceases often of its own accord, even as too rich Wines are depressed, by their own growing hot, and are wont to be reduced into their due state: but this melancholick Dyscrasie of the Blood, in which, with a want and defect of Spirits, Salt and Earth are too much exalted, (as when Wines grow sour) is most hard to be restored, and is almost of the same labour and difficulty, as to put again life, and a vinous Spirit, into Vinegar: For that the Blood, depraved after this manner, may be restored, it will be needful, that its whole mass should be volatilised, and as it were made Spiritual anew: wherefore, in this case, evacuations profit not a jot, yea, by more depauperating the Blood, oftentimes the strength is cast down, beyond help: but they had need to exalt, and make volatile what is fixed, and to promote a Transpiration, or Spiritualisation, in the whole mass of Blood: From hence it is, that in this Disease, the change of the Air and Region, most often brings help, before all other Remedies: For the Spring following, oftentimes takes away those Quartan Feavers, that had arisen the Autumn before: which without doubt happens, because the changed condition of the Air, is wont to alter for the better, the evil disposition of the Blood: also for the same reason, the change of the place, most often cures this Distemper, inexpugnable to all Physick.

If it be demanded, wherefore this Disease chiefly begins in the Autumn; and rarely in the Spring, or Summer time; I say, the Autumnal time doth most fitly produce this kind of Feaverish disposition of the Blood, for when very much of the Spirit, and Sulphur, hath flown away by the Summers heat, and that what is left begins to be bound up by the cold; the Liquor of the Blood, (as Wine growing sour by too much heat) easily degenerates into a saltish, and acidulous or sharp Nature: This also, the Sea air, by infecting the Blood and Spirits, with saline Vapours falling on them, easily procures: yea, also the affinity of this Disease, with the Scurvy, and Hypochondriac distemper, plainly shews, the evil disposition of the Blood to be in fault, whereby it becomes salt, and earthy, with the want of Spirit.

Concerning Quartan Feavers, the last year was so abundantly fruitful of observations, that many might collect by ocular Inspection, whatever belong to this Disease; for when the most hot Summer was past, about the end of it, an Epidemical Feaver (of which in another place you shall have a description) followed; then the Autumn coming on, when that Disease had ceased, a Quartan Feaver began very much to rage; that in very many places, the fourth part of the people was taken with it: neither did it only infect old men, splenitick and melancholick men, but of every age and temper, also Infants, Children, and young men ordinarily: which was clearly a sign, that this Distemper had drawn its rise, not from a melancholick humour, heaped up, by the default of the Spleen, but from the Dyscrasie of the Blood, brought in, through the intemperance of the year: for the mass of the Blood, after too great heats, even as Wines after immoderate effervescencies, was made fit to grow somewhat sour, or to get an austere disposition, and so also prone to this sort of Feaver, as is already shewed.

If the Remedies, which for the Curing of this, have been made tryal of, both by Physicians and Empericks, were collected together, their description would swell into a great Volumn; but altho there is instituted, a manifold provision of Medicine, against this evil, yet very few are cured in the Autumn. In some, about the beginning of their sickness, before the Disease has taken too deep root, a Vomit hath brought help; but in most, all manner of Cathartics, tho an hundred times repeated, have profited nothing. In whom the evil had deeply implanted it self, the sick received no help, from the most studied Medicines made use of all the Autumn. But when at this time, I perceived the ordinary method of Medicine, was administered in vain, I proposed to a Noble Virgin, requiring a sudden Cure, by any means, to be performed, that if she would endure a Flux at the Mouth, for some days, from a Mineral Medicine, by that means, it might be hoped, that the Disease would be profligated. When she had readily assented to this, I gave her a gentle, and very safe Medicine, by which a light spitting only was provoked, and that finished within twelve days: As soon as the Salivation began, she mist her fits, but at those times they were wont to come, she felt a perturbation in her whole Body, with an oppression of the Heart, and dread

of swooning, but after the spitting was finished, she appear'd very well; and when again after two months space, she was troubled with some light fits of this Disease, from an Emetick powder, twice or thrice taken, she was wholly cured without relapsing.

After the winter Solstice, this Disease began to rage less, and to cease in some of its own accord, and in many others, to be easily expung'd by the use of Physick: because at this time, the Dyscrasie of the Blood, contracted by the Summers heat, is wont to be blotted out leisurely, by reason of the cold of the Winter, and the mass of Blood growing old, as it were to put off its old spoils, and to be reduced towards its natural State. But those, who were of a melancholick temper, or had their viscera, and especially the Spleen, evilly affected, or that used an ill manner of Dyet, received no change at this Tropick, but to the next period of the year, *viz.* to the vernal Equinox, or the Spring, kept the Disease; and then in most, the Blood being either restored of it self, or its intemperance more easily mended by the use of Remedies, this Distemper was seen to be overcome: But in the mean time, many old men, and such as were full of evil humours, or otherways unhealthy, ordinarily dyed, in all that space of time, of this Disease; also some liv'd, who could not shake off its yoke, tho the Summer Solstice were past. But altho very many had labour'd with this Feaver, as it were Epidemical, almost thorow the whole year, yet none (that I know) contracted it first in the Spring, and very few grew well of it during the Autumn, that in truth, I do not doubt, the Dyscrasie of the Blood, to be the cause of this, and the cure to consist in the change of it.

The Remedies, which most often brought help, (as appeared at least to our observation) were of this sort, which did restrain the Feaverish Fit: for the evils of the disposition of the Blood, being somewhat mended, by the time of the year, being changed, if now the habitual custom of the Fits were broken off, Nature recollected her self, and easily recover'd the pristine state of health, by her own endeavour. And this kind of intention, (to wit, the inhibition of the Fits) tho sometimes performed by Vomits, given a little before the coming of the Fit, (for these did not rarely stop the Feaverish motion of the Blood, by raising up another motion contrary to this) yet this Indication is far more certainly, and indeed happily effected, by the use of those kind of Medicines, which do not altogether evacuate from the Viscera, but induce, either a certain fixation to the Blood, or a precipitation of the Feaverish matter, for a time. Wherefore, those whom I undertook to cure, in the Spring, and afterwards; I handled (and in most with good success) with this method; a provision being made of the whole, sometimes with an Emetic Medicine, sometimes with a Solutive; I was wont three hours before the Fit, to lay a peculiar Ague-Medicine to the wrists, and together, to give them to drink in Sack, an Ague-resisting powder, and to order the sick to be kept in Bed in a gentle sweat: It seldom hapned, but at the first, or second time, the Feaverish Fit, was by this means restrained, and then, by the same Remedy, sometimes reiterated, the Disease at last wholly ceased. To this kind of practice, (besides our experience) the use of the powder, of a certain Bark, brought of late from the Indies, seems to give some Faith, and approbation; which is said, most certainly to cure this Disease; but the vertue, or operation of this, without any evacuation, consists in this only, that it hinders the coming of the Feaverish Fits.

Concerning this Peruvian Bark, because of late it hath begun to be in use, there are some things to be said, which offer themselves to common observation. The common manner of exhibiting this is, that two drams of it beaten to powder, be infused in Sack, or Whitewine, in an open Glass, for two hours, and then upon the coming of the Fit, the Patient being put to Bed, that the liquor and powder be drunk up. This potion often takes away the approaching Fit, yet oftentimes tho taken after the wonted manner, it prevents the next, however, either in the first, second, or third period, the Fit is inhibited, and the Disease seems to be cured, it is often wont to return, within twenty or thirty days; then this powder being again exhibited, the Disease is for a time deferred about the same space, and by this means, I have known many sick of a Quartan, to have suffered some few Fits only, a whole Autumn, and Winter, and so to have detained the enemy in his precincts, till the Spring coming on, the disposition of the Blood is altered; for the better, by the help of the time of year, and of other Physick, and so this distemper vanishes by degrees. Those who by this means, have procured these frequent truces of the Quartan, have liv'd chearful, lively, and ready for any business, when otherwise, being weak, and pale, they were brought into languishment,

ment, and a vitious habit of Body : scarce one of an hundred, hath tryed this Medicine in vain, yea, if but half, or a lesser quantity, *viz.* the weight of but one dram, taken, it very often takes away the Fits, and suspends the same, a shorter space only ; neither is it any matter, whether it be taken in strong, or small Wine, unless with the respect, to the disposition of the sick : because in a more hot temper, it may be profitably taken in distilled Water, or Whey ; also, a clear infusion of it, the more thick substance being cast away, produces the like effect, but of shorter durance : I have taken care to reduce this powder into Pills, with the mucilage of Tragacanth, with a little cost to the sick, to be given to some ; after what manner soever it is taken, unless, to those loathing and abhorring every Medicine, it causes no manifest evacuation, and takes away the Fit, almost from all ; neither is it only in a Quartan Feaver, but in the other kinds of intermitting Feavers, to wit, in every one where there is any remission coming between, given with good success. It is commonly ordered, that a gentle Purge should be taken before this, but in some who are very weak, and keep their Beds, this powder being taken carefully, without any previous Medicine, hath procured laudable effects. In the mean time, I will ingeniously confess, that I have not seen an intermitting Feaver quite cured, by this Bark, once taken : nay, rather the Fits not only of a Quartan, but of a Tertian, and Quotidian Feaver, wholly overcome easily by other Remedies, seeming to be driven away by this powder, have constantly return'd after a short time. For this Reason, they who suppress intermitting Feavers, otherways easily curable, no necessity urging them, by this Medicine, for a little while, only seem to institute a deceitful Medicine, and do no more than those, who skin over a rotten Ulcer, which will shortly break out again ; in truth, in some cases, the use of this will be requisite, *viz.* when by the too great assiduity of the Fits, the spirits of the sick are cast down, truces are by this means procured, by which Nature may recollect her self, and afterwards may be more able to fight against this potent Enemy : also, that a Quartan Feaver, during the Autumn and Winter, may pass over with little trouble, this Bark is profitably administred : But those, who expect a longer resting time, from the assaults of this Feaver, are bid to take this powder in greater quantity, and more often, to wit, that they should take two drams, three several times one after another, whether the Fits return or no ; by this means, they remain longer free, yet they retain within, the Enemy still, tho asleep.

If it be demanded, concerning the Nature of this Bark, and the virtue in suppressing the fits of Intermitting Feavers, it is not to be dissembled, that 'tis very difficult to explicate the causes of these kind of effects, and the manner of working ; because, there is not found as yet in any Subject, besides, the like efficacy ; but from a singular experiment, a general Reason is not to be rightly fitted : however, from the appearances diligently Collated, we will deduce some Theses in order, which may make at least some steps towards, if not obtain the verity of this thing.

It is to be noted therefore, in the first place, that this Medicine, being inwardly taken, especially exerciseth its force and energy on the mass of Blood ; because, it does not at all irritate the Viscera, neither causes in them any excretion, or trouble ; besides, whilst it communicates its virtue to the Blood, it doth not at all put forth Antifeaverish property ; wherefore, not always the next following fit, but the second, or the third, is prevented, by the same being taken : and for this reason, that it may sooner affect the Blood, it is a usual thing, to drink the Liquor, very much impregnated with the same powder, for so its Particles are more easily conveyed into the mass of Blood. Secondly, the virtue of this Bark, being impressed on the Blood, stays in it for some time, and that either shorter or longer, according as either a greater or lesser portion of the Medicine was taken inwardly ; for the Particles of this, being confused with the Blood, are a long while circulated with it, and by how much the longer they stay, by so much the more they affect its mass, and produce a longer effect : for though Aliments, and some other things taken in, for that they are presently overcome by the native heat, put off whatever they have of virtue, within some few hours, this being then assimilated or sent forth adooors, they cease to operate : yet some Medicines being taken inwardly, because they are not easily tamed, nor cast forth of doors presently, by an irritation stirred up, they remain for many days very active, and hold a long time the Juices, and the Blood, in this or that manner of Fermentation, this may be observed of some Medicines, also of Poysons, and Counterpoysons, the once or twice taking of which, for some days, is wont to affect our Bodies

Bodies for a longer time; for 'tis an usual thing with Cathartic Medicines, when they work little by Vomit, or Stool, to break forth after many weeks outwardly, in Pustles and Wealks: yea, if Death be avoided, from the drinking of Poyson, every body knows, that the virulency will lie hid, a long time in the Blood and Juices. In like manner also, this powder, and perhaps very many other things inwardly taken, altho they seem asleep, yet continue to act, on the Spirits and Humors.

Thirdly, altho this Medicine acts immediately on the Blood and Humors, yet it takes not wholly away, the Feaverish Dyscrasie, implanted in them: for, as soon as its force is consumed, and all its Particles are flown away, from the mixture of the Blood, the Distemper being only suppressed for a time, at length rises up, and repeats its fits after its wonted manner, but forasmuch as Nature, by the space of this cessation, becomes stronger, therefore, after the Relaps, the fits (not as before) but on the third or fourth day, according to the first figure of the Disease, are wont to return.

Fourthly, It is remarked, that this Remedy, does not stop the Feaverish accessions, as the ordinary Ague-resisters or Febrifuges, by fixing, or also by fusing the Blood; for then the next fit always, and not the second, or third following after, is prevented.

According to which positions, that we may instead of a Corollary, subjoin some things concerning the manner it self of working, whereby this Medicine seems to act; we say, it is most likely, that when the Particles, proceeding from the same being taken, are thoroughly mixed with the Blood, they compel it into a certain new Fermentation, by which, whilst the Particles of the Blood are continually agitated, they are wholly hindered, that they cannot heap up any Excrementitious matter, or enter into Feaverish turgescencies; for, as after the biting of a mad dog, or stinging of any venomous Creatures, the Blood it self, and nervous Juice, are a long while impoysoned, yet lest they should conceive presently great irregularities, Counter-poysons being taken, do hinder their Liquors, by retaining them in another Fermentation; the use of which, if so long continued, whilst the virulent little Bodies are quite flown away, no horrid symptom is to be feared, from that evil being contracted; but if the strength of the Remedy, being too sparingly given, be first consumed, forthwith the Venom repullulates, and the old Poyson, thought to have been exploded, is at length brought into act: by the same way, when the Blood, having gotten a vitious disposition, perverts the Alible Juice, and whereby it might more rightly expel it, heaped together to a fulness, conceives Feaverish swellings up; this Peruvian Bark being beaten, and administred, by the Commerce of its Particles, so agitates the Blood, tho distempered with an evil disposition, with a new excited Fermentation, and alters it, that it in some measure concocts the nourishable Juice, and continually evaporates its Recrements, that they are not heaped together as before, into the matter of a fit: But, when the Particles of this Remedy, are wholly flown away, from the company of the Blood, and the whole virtue consumed, the evil disposition of the Blood, before contrancted, at length rises up, and so the Feaverish fits return, after their wonted manner. Sometimes perhaps it happens, that whilst the Feaverish fits are suppressed, by the use of this powder, by reason of the season of the year being changed, or by the help of another Remedy, or by the endeavour of Nature it self, that Dyscrasie of the Blood may be mended, by degrees, and so the Feaver may at length vanish, of its own accord. This I have known to happen, but very rarely, because almost with the same certainty, by which you expect the Feaverish fits to be suppressed, by that powder, you may afterwards look for their return.

As to what appertains to the sensible qualities, with which this Bark is noted, it appears to abound with bitterness, and a certain stipticity, that it seems to the tast, to have the likeness of Savor, which is in most Conterpoysons, as the Root of Gentian, Serpentary, Contrayerva, &c. for what are bitter in act, are strong in excellent virtue, for the suppressing the force of preternatural Ferments; yea, the Root of Gentian, which is likest to this Bark, was in times past of famous use, for the Curing of Quartan Feavers. But now, altho this Peruvian powder, be the only Alexiterion or Counter-poyson, as yet found out against a Quartan Feaver, to wit, that inhibits (tho only for a time) its fits, and of other Intermitting Feavers, yet it is not to be doubted; but that there are in the world, other Medicines extant, which are as good Ague-resisters; and it is hoped, that led by the example of this new invention, we may be excited, to the finding out the virtues of Herbs, almost as yet unknown: so,
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whilst we shall insist on the trial of several, and the Empirical be joyned to the Rational Medicine, without doubt the Cures of the Quartan Ague, and of other invincible Diseases, may more happily be accomplished: which therefore I promise more willingly to this Age, or at least to the next, when being led by the Analogy of this Book, I have found out a Medicine, for the profligating of Feavers, of use not contemptible, it not being long since variously tryed, which also I am wont to give to the poorer sort, instead of something else, with good success.

C H A P. VII.

Of continual Feavers.

A Continual Feaver is that, whose fit is continued for many days, without intermission: It hath its times of remission, and of more fierceness, but never of intermission; the burning is now more remiss, now more intense, but still the sick are in a Feaver, until by the temperament, or insensible growing well, the Disease is wholly Cured. Concerning this, it behoves us to inquire, what Effervescency of the Blood it is, which causes a continual Feaver; then, by what ways, and from what causes, it is wont to be excited: also, how it differs from that, which is in Intermitting Feavers. And these being performed, we will descend to the Species of Continual Feavers.

There are many ways, by which the Blood growing hot, induces a continual Feaver, the chief of which may be reduced to these Heads: The first way is, when the more spirituous, and subtil Portion of the Blood, becomes too hot, and is disordered, with a certain burning, which therefore agitates the other parts of the Blood, and incites it into a certain rage, so that the Sulphur, or the Oily part of the Blood, is more dissolved, and more inkindled in the Heart, also, for that cause, there is among all the Particles of the Blood, a certain syncrasis, contrariety, or perturbation, by which in truth, being confused, and put out of order, they are not able quickly to be extricated, and reduced into their former posture, wherefore, a heat and burning more than is wont to be, is stirred up in the whole Body: but when the Spirits are only in fault, their heat and disorder, are wont within a short space, to be allayed of their own accord, therefore, this Feaver is often terminated within a day, and is rarely continued beyond three: and therefore, is called an Ephemera, or a Feaver of a day, or Synochus of more dayr,

2. The second manner, or degree of growing hot, is when the Sulphureous or Oily part of the Blood, being too much heated, conceives a Fervor: for then, it both grows immoderately hot in the Vessels, and being very much inkindled in the Heart, produces by its deflagration, a very strong heat in the whole Body. Indeed the Blood, as to its temper, mostly depends on the condition of the Sulphur; when by reason of crudity, the Sulphur is less dissolved, the Blood is made watery and cold, and is moved slowly in the Vessels: but if the Sulphureous, or Oily part of the Blood, grows hot, beyond its Natural disposition, presently it becomes fierce, and impropionate with the rest, so that, almost the whole being acted, as it were into a flame, by the Ferment of the Heart, compels the mass of Blood to grow immoderately hot, and to boil up. For as when Wines, indued with a rich Lee, are stirred up into an heat, by the too rancid Sulphur; or as Hay, laid up too wet, by reason of the want of Ventilation, conceives of its own accord a burning, the Particles of the Sulphur being loosened from the mixture; in like manner, when the Blood is not rightly ventilated, but being restrained from Evacuation, by reason of the admixtion of some hot thing, or a more plentiful sanguification, or for some other cause, the Particles of the Sulphur begin to be thickly gathered together; presently, all its Liquor, immoderately boils up, by the Sulphurs being loosened, and inflamed in the Heart, and this kind of Feaver is induced, which is called a putrid Synochus; notwithstanding which appellation, tho of many rejected, for that the Blood so long as it is in motion, doth not putrifie; yet forasmuch, as in this Feaver, the mixture of the Blood, is somewhat

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loofned, by the Sulphur being too much exalted, and the mafs of its Liquor being changed, from its Natural difpofition, tends toward putrefaction, therefore, the term of a putrid Feaver, as hath been anciently ufed, may be ftill, with good reason, retained.

3. The third degree of growing hot, (and which constitutes a diftinct kind of continual Feaver) is excited, from a certain malignant, and invenomed Ferment, by which, when the mafs of the Blood is imbued, and the Spirits, and the Sulphureous part together, conceive an heat, and their burning is not fooner appeafed, than that either that malignant matter be consumed, and caft forth of doors, or elfe a certain coagulation, and as it were putrefaction, of the Blood, from its corruptive venom is induced, by which, both circulation is hindered, and the Vital Spirit extinguifhed. This malignity is wont to arife, either from a certain contagion received from without, or from fome infection begotten within us; according to thefe ways the malignant Feaver, Small-pox, Meafels, and alfo the Plague, draw their beginnings, and by their contagion, far and near fet upon many.

There are therefore three degrees, or manners of growing hot, by which, the kinds of continual Feavers are determined. From the fubtil portion of the Blood made hot, or the Ebullition of the Spirits, the Ephemera arifes, as alfo the Synochus of one or more days: by the Sulphureous, or Oily part of the Blood, being too hot and inkindled, the putrid Feaver is ftirred up, then thirdly, upon an invenomed taint, infecting the Blood, and congealing its Liquor, malignant Feavers depend. In every one of thefe, by the depravation, or rather corruption of the Alible Juice, frefh carried into the Blood, the various fits, inequalities, and critical motions arife. But before I enter upon the feveral kinds of a continued Feaver, it is requifite for me, to confider, how the growing hot of the Blood, in a continual Feaver, differs from that other, which constitutes Intermitting Feavers.

I fay therefore, that the growing hot of the Blood, in an Intermitting Feaver, depends only, upon the commixtion of a certain Fermentative matter, and not rightly mifcible, with the Blood, and on its growing up, to a fulnefs of boiling over. Becaufe of this heat, with the Blood in the Veffels, and of the deflagration in the Heart, the fit is induced; becaufe of its growing cool, the intermiffion follows, that in the coming between of the fits, neither the Spirits, nor Sulphur, become outrageous, but the bond of the mixture being kept whole, the Liquor is circulated in the Veffels, equally, and without trouble: on the contrary, in a continual Feaver, the diforders of the Spirits, and of Sulphur, of either, or both together, by their proper Ebullition, alfo without the mixture of any other, ftir up the Ebullition of the Blood; wherefore, there are required, for an intermiffion, befides the diffufion or cooling of the Excrementitious matter, a deflagration of the inkindled Blood, and a reduction of it to its due Temper.

The Conftitution of the Blood in a continual Feaver, is of the fame fort as of Wines, when they grow hot upon too rich a Lee; to wit, are mighty in Spirit, and grow turgid with exalted Sulphur, and therefore they conceive a Fervor, and greatly boil up, of their own accord, without the mixture of any other thing. In an Intermitting Feaver, the Blood is moved after that manner, as Wines, when they conceive an heat, becaufe of fomthing poured to them, that is not mifcible with them: Moreover, in this Feaver, the difpofition of the Blood is of that fort, as of Wines, when in their decay and declination, they become ropy, unfavory, or acid, to wit, in which the Spirit is deprefsed, that in the mean time, either Salt, or Sulphur, or both together, appear above the reft, and infect the whole Liquor with their diforder. An Intermitting Feaver, for the moft part, is free from danger, becaufe the conftitutive parts of the Blood, altho they fhould fomewhat change their difpofition, however, keep the bond of mixture, and whilft they are in power, are circulated equally in the Veffels, yea they pervert the nutritious Juice, into a matter, not altogether befides Nature, but rather infecting, with its fulnefs and turgescency. In a continual Feaver, befides the intemperance, the mixture of the Blood, and conftitution of the Liquor, are fomewhat loofned, and its corruption eafily follows; wherefore this Difcfe often ends in death: further, the nourifhing Juice is depraved, into a matter wholly vitious, and altogether infeftous to Nature.

C H A P. VIII.

Of the Ephemera or Feaver for a Day.

I Have said, the least degree of heat, which induces a continual Feaver, is placed in the subtil, and Spirituous part of the Blood, being too much agitated and heated; for this, like the Spirit of Wine, boils up on every light occasion, and conceives a fervor, by a too great motion of the Body, or perturbation of mind, by the ambient heat as of the Sun or vapours, by hot things taken inwardly, as the drinking of Wine, and the eating of peppered meats, and being irritated by such like. For the Spirits of the Blood, easily take fire, and being impetuously moved, are not presently appeased, but they move throughly other Particles of the Blood, variously confound, and snatch them, into a rapid and disorderly motion; also from this motion of the Spirits, the Sulphur, or Oily part of the Blood, is more boiled forth, somewhat more dissolved, and something more fully inkindled in the Heart, by which means, an intense heat is raised up, in the whole Body. But forasmuch, as Sulphur is inkindled, and inflamed only by small parts, and not in the whole, that fervor of the Spirits is quickly appeased, and ceases: wherefore, the Feaver which is excited by this means, for the most part is terminated, within twenty four hours, and therefore is called an Ephemera, or a Feaver of a day. If that by reason of a greater heat of the Spirituous Blood, it is prolonged further, it rarely exceeds three days, and is called an Ephemera of more days, or a Synochus not putrid: but if it should happen to be lengthned beyond this time, this Feaver easily passes into a putrid, *viz.* from the daily Ebullition of the Spirituous Blood, the more thick Particles of the Sulphur, at length begin to take fire, and involve the whole mass of Blood, in its Effervescency: even as the Spirit of Turpentine, being shut up in a Cucurbit, and being put into a Sand Furnace, if it be forced with a moderate heat, boils up gently, as the Blood in a Feaver of a day; but if the heat be made more strong; the Liquor grows impetuously hot, till it breaks forth into a flame, to which the inflammation of the Blood, in a putrid Feaver, may be very aptly compared.

The Days Feaver, and Synochus simple, rarely begin without an evident cause: Besides what hath been but now said, immoderate Labour, Watchings, a sudden passion of the mind, a constriction of the pores, a Surfeit, also a Bubo or inflamed Sore, a Wound, the coming down of the Milk in Child-bearing Women, are wont to induce them: The procatartic Causes, which dispose to this, are an hot temper of Body, an active habit, a sedentary life, and disuse of exercise.

The chief beginnings of this Disease, depend upon the presence of the evident cause: for either, little Bodies of extraneous heat, being confused with the Blood, like water boiling over the fire, make it to boil up; or this Feaver is induced, by motion, or by reason of transpiration being stopped; even as Wines made hot by motion, or when too closely stopped in the Ton, are put into a Fervor: but what way so ever an inflammation is first excited, presently the Spirits become enraged, and being moved hither and thither, compel the Blood to boil up, and to be enlarged into a greater space, with a spumous rarefaction: wherefore, the Vessels are distended, and the membranous parts hauled, hence follow pain, chiefly in the Head and Loins, a spontaneous weariness, and as it were an inflation of the whole Body. If that, with the Spirit of the Blood, a certain Sulphureous part, be also in some measure inkindled, a sharp heat is diffused through the whole, the Pulse is vehement and quick, the Urine red, also thirst, watchings, and many other symptoms infest; the reasons of which are added hereafter.

Concerning the Solution, or Crisis of the Ephemeran Feaver, and of the not putrid Synochus, three things are chiefly requisite: *viz.* a removing of the evident cause, secondly a separation, and a scattering of the depraved, or excrementitious matter, from the mass of Blood: Thirdly, a quieting of the parts of the Blood, and a restitution of them, to their natural and equal motion and site. According as these succeed, now more suddenly, now more slowly, and difficultly, this Disease is finished in a shorter, or longer time.

1. The evident cause, which for the most part is extrinſick, is eaſily removed, and the ſick are wont, preſently to avoid the preſence, or aſſiduity of that thing, and do perceive a ſenſe of any thing that is hurtful; none taking a Feaver from Wine, will ſtill indulge the drinking of it, as ſoon as any one grows more than uſually hot, in a Bath, or the heat of the Sun, 'tis a trouble to them to ſtay longer.

2. As to the Excrementitious matter, which ought to be ſcattered, and ſeparated from the Blood: this is either brought from without, as when the Blood is infected by ſurfeit, drinking of Wine, ſitting in the Sun, or from a too hot Bath, with *Effluvia*, or little dry, and Fermentative Bodies; or this matter is begotten within, as when its Liquor is ſtuffed with recrements, or aduſt Particles, from the deſlagration of the Blood. Either of theſe matters, ought to be ſeparated from the Blood, to be diſperſed, and either by ſweat, or inſenſible breathing forth, to be thruſt out of doors, before the Feaver be appeaſed; wherefore, when as the pores are bound up, and tranſpiration hindered, the Ephemeran Feaver is longer protracted, and ſometimes paſſes, from a ſimple Synochus, into a putrid.

3. The evident cauſe being removed, and this degenerate matter diſperſed, there is required for the remiſſion, a quieting, and reducing into order, the parts of the Blood; for diſverſe Particles of the Blood, being after this manner confuſed; and by reaſon of the Feaveriſh heat, carried up and down, they do not preſently get again the former order of ſituation and poſition; but it is needful, that they be by degrees extricated, and by little and little reſtored, to a juſt mixture.

Although this Diſeaſe, after the removing of the evident cauſe, for the moſt part ceaſes of its own accord, within a while, yet ſome Medicinal Remedies may be adminiſtered, with good ſucceſs, eſpecially, when there is danger, leſt the Ephemeran Feaver, ſhould paſs into a putrid. The chief intentions ſhould be, to ſuppreſs the fervor of the Blood, and to procure a more free tranſpiration; to the which conduce, firſt a breathing of a Vein, a ſlender diet, or rather abſtinency, cooling drinks, and a bringing away the filth of the Belly, by Clyſters: Sleep, and Reſt, greatly help, above all the reſt; which, if wanting ſhould be procured in time, by Opiats, and Anodynes.

Verily, altho the Hiſtories, and Obſervations of thoſe, diſtempered with an Ephemeran Feaver, contain in themſelves nothing very rare; yet I ſhall ſubjoin an example or two, in this place, whereby the delineation or type of this Diſeaſe, may be illuſtrated.

A certain young Gentleman, about twenty years of Age, endued with a ſtrong habit of Body, by the immoderate drinking of ſtrong Wine, fell into a Feaveriſh diſtemper, with thirſt, heat, and with a great burning of his Precordia; being let Blood, he drank a great quantity of fair water, and upon it preſently a plentiful ſweat following, he grew ſhortly well: In this caſe, the more thin portion of the Blood, being heated by the Spirits of the Wine, fell into a rage, cauſed the whole maſs of Blood to be ſhaken, and its frame to be looſned, more than twas wont; and for that reaſon, that hapned to be more diſſolved, by the Ferment of the Heart, and to be as it were inkindled by the active Particles, looſned from the mixture; until the Veſſels being emptied by Phlebotomy, the raging Blood was cooled, and by the drinking of the water, its fervor was attempered; then the hot *Effluvia*, being involved, together with the aduſt matter, with a copious *Serum*, and ſent away by Sweat, the Blood at length recovered its due temper. Moreover, an ingenious young man, of a ſedentary life, and alſo very much addicted to the Study of Learning, when he had for ſometime exerciſed himſelf, beyond his ſtrength, in the hot Sunſhine, he began to complain of the pain of his head, a want of Appetite, a heat of his Precordia, and of a Feaveriſh diſtemper all over; to whom, (for that he was wholly averſe to Phyſick) I ordered an abſtinence from all things whatſoever, unleſs from Small-Beer, and Grewel; on the ſecond day, and ſo more on the third, the ſymptoms remitted, by little and little, on the fourth, he went home freed from the Feaver, without any Medicine.

C H A P. IX.

Of a Putrid Feaver.

SO much for a Continual Feaver, which is raised from the most simple heating of the Blood, or its lowest degree of inordinate heat; that which depends on a greater degree of heat follows, *viz.* when the Oily or Sulphureous part of the Blood, being too much heated, swells up above measure, and as it were forced into a flame; and therefore from the similitude, by which humid things putrifying, conceive an heat, this kind of Ebullition of the Blood, because it induces an immoderate heat, is called a putrid Feaver: which name ought to be retained without injury, because that in this Feaver, the Synthesis of the Blood, (as is wont to happen in putrifying Liquors) is very much unlocked. When the Spirits only grow enraged, (as in an Ephemera) the frame of the Blood is somewhat set open, and loosened, that it is more dissolved, by the Ferment of the Heart, than is wont, and more Particles than naturally use to do, leap forth, and diffuse a more intense heat; but yet the mixture of the Liquor, as to its chief parts, is conserved. But when the Sulphureous matter taking fire, grows hot above measure, the bond of the mixture, for the greatest part, is loosed, that its Principles are almost wholly drawn away, by the Ferment of the Heart, and the active Particles, being loosened from the mixture, break forth as it were into a flame. Wherefore, the Liquor of the Blood being after this manner rarified, in the Heart, and as it were inkindled, is from thence carried, through the Vessels, with a most rapid motion, and disperses very many *Effluvia* of heat, from its deflagration. Hence, the whole mass of Blood, (like water put over the fire) continually boiling, distends the Vessels, pulls the Brain and Nervous parts, raises up Convulsions, and pains in them, very much destroys the Vital Spirits with its heat, waists the Ferments of the Bowels, hinders the Offices of concoction, and dispensation, often depraves the nourishing Juice, destinated for the Nervous stock, that from thence exceeding great disorders of the Animal Spirits follow; yea almost perverts the whole œconomy of Nature.

The course of this Disease shews it self after this manner; It rarely begins without a procatartic cause, or previous disposition: to wit, the Sulphureous or oily part of the Blood, is first too much carried forth, and exalted beyond its due tenor, which afterwards, either of its own accord, (like Hay not eventilated) begins to grow hot, or by the coming of an evident cause, it is forced into a preternatural heat. But when it grows turgid in the first place, by reason of the admixtion of a crude Juice with the Blood, now a shivering, now heat infests, which shew themselves unequally, like fire, which is covered with green wood, sends forth now smoak, now flame: But at length, the fire glowing more largely, as here the victor fire spreads it self abroad, so there (sooner than said) the whole mass of Blood is inflamed, and is urged at once with heat, and a most swift motion: Nor is this immoderate heat of the Blood appeased, before its active particles being loosened from the mixture, and then successively inkindled in the Heart, are wholly burned out, which doth not happen, but in the space of many days. And then at length this Feaver ceases, when the remaining Liquor of the Blood, the Spirit and Sulphur being very much consumed, being made lifeless and poor, is fit only for a weak and small fermentation. From this kind of deflagration of the Blood, and also of the alible Juice, (by the same fire burnt out) the recrements, or little Bodies of torrifed matter, are heaped up in the Blood; which yet do more promote its fervor, and ebullition, and for a time, increase the Feaverish distemper. After the Blood hath very much burned forth, and these kind of little Bodies, are gathered together to a fulness of swelling up, the vital Spirit endeavors a separation, and tries to concoct, and to overcome, (what it may) these adust recrements, and then, having put a great many of them into a swelling up, a Flux being risen, strives to shut them wholly out. And indeed, in the subaction, and seclusion of this matter, chiefly consists the event of this Disease; for if the vital Spirit being strong, the Bloody humor (when it hath sufficiently burned forth, and shall be freed from these

these adust particles) should recover its pristine tenor, whereby it is made fit for motion, and a due fermentation in the Heart, the sick tends towards health; but if, by a long deflagration, and an inextricable confusion of the morbid matter, the liquor of the Blood, being wanting of Spirits, and more pure Sulphur, or those same (by the impure mixture growing ill) being as it were put under the yolk; is rendered so lifeless, that it is not any longer rarified, by the ferment of the Heart, or inkindled; by degrees, its heat, and motion, together with Life itself decays.

The procatartick causes, which dispose to this Disease, are, an hot and humid Temper, an active habit of Body, a youthful Age, the Spring time, or Summer season, a high and rich Dyet, besides the often drinking of rich Wines, a sedentary and idle life, a Body full of gross humors, and stuffed with vitious Juices; but above all the rest, it appears by observation, that the frequent letting of Blood, renders men more apt to Feavers; wherefore it is commonly said, from whom Blood is once drawn, that unless they do the same every year, they are prone to a Fever. The reason of this is, (unless I am deceiv'd) by the frequent letting of Blood, the Sulphur is more copiously gathered together, in the mass of Blood; in the mean time, the Salt (which should bridle it, and hinder it from raging) by this means is drawn away; for the Blood, the older it grows, becomes so much the more Salt, the Salt of all the Elements not evaporating. But by how much the more the Blood abounds in Salt, by so much the less it abounds in Sulphur; for Salt eats and consumes the Sulphur, and makes it evaporate: wherefore, they who are lean, and abound with a Salt Blood, are less prone to Feavers. But when, by the letting of Blood, the ancient Blood is drawn forth, in its stead another more rich, and more impregnated with Sulphur, is substituted; so that it becomes less Salt, and more Sulphurous. Hence it is, that those who often let Blood, are not only prone to Feavers, but also are wont to grow fat, because of the Bloods being more impregnated with Sulphureous Juice.

The evident causes, which deduce the latent disposition of this Fever into act, are of the same sort, which procure an Ephemeral Fever, and simple Synochus; in this rank chiefly come, Transpiration being hindered, and Surfeiting. By reason of the *effluvia* being restrained, the mass of the Blood being increased in bulk grows turgid, and conceives a Fervor, as it were from a certain ferment, inspired anew, and cruelly boyles up; from thence, presently the pores are more obstructed, by the infarction of the *effluvia*, and the frame of the Liquor being loosened, the particles of the Sulphur, exuberating in the Blood, leap forth from the mixture, and are inflamed by the ferment of the heart, as it were by fire put to them, and so they enkindle a very intense Fever. But from a Surfeit, both an immoderate fermentation is induced in the Blood, and also a nitrous Sulphureous matter, apt for adustion, and an inkindling is conveyed, as it were food, to the burning Blood.

In this Fever, four times or seasons are to be observed, in which, as it were so many posts, or spaces, its course is performed: These are then, The Beginning, the Augmentation, the Height, and Declination. These are wont to be finished in some sooner, in others more slowly, or in a longer time. The beginning ought to be computed, from the time the Blood begins to be made hot, and its Sulphur to conceive a burning, untill the ardors, and burnings are diffused, thorow the whole mass of Blood. The Increase or Augmentation, is from the time, that the Blood being made hot, and inkindled thorow the whole, burns forth for some time, and its mass is aggravated with the Recrements, or burnt Particles, which increase the fermentation. The state, or standing of the Disease, is when (after the Blood has sufficiently burned forth, and its burning now remits) the long vexed Blood, like a noble wrestler, when his adversary is a little yielding, recollecting all his strength, endeavours a bringing under, and a separation of that adust matter, with which it is filled to a plenitude, and also, a Crisis or separation being once or oftner attempted, an expulsion of it forth of doors. The Declination succeeds after the Crisis or secretion, in which the Blood grows less hot, with a languishing fire, and either, (the vital Spirit being as yet strong) overcomes what is left of that adust and extraneous matter, and by degrees puts it forth, until it is restored to its former vigour; or, whilst the same Spirit is too much depressed, the liquor of the Blood, is still stuffed with adust recrements, and therefore becomes troubled and depauperated, that it neither assimilates the nourishing Juice, nor is made fit for an accension in the heart, for the sustaining the lamp of Life.

1. When therefore any one is taken with a putrid Fever, the first assault is for the most part accompanied with a shivering or horror: for when the Blood begins to grow

grow hot, there is a flux made, and a swelling up of the crude Juice, freshly gathered together in the Vessels, even as in the fit of an intermitting Feaver, heat, and sometimes sweat follow, upon the shivering, by which, the matter of that crude Juice is inkindled, and dispersed: afterwards, a certain remission of the heat follows, but yet from the fire still glowing in the Blood, a lassitude, and perturbation with thirst, and waking, continually infest: A pain arises in the Head, or Loins, partly from the ebullition of the Blood, and partly from the motion of the nervous Juice being hindered; also a nauseousness, or a vomiting offends the Stomach, because the Bile, flowing out of the Choleduct Vessels, is poured into it, and a Convulsion from Vapors, and from the sharp Juice brought thorow the Arteries, is excited in the Stomach. In the mean time, altho the heat be more increased, and unequal, it is not yet strong, because the Blood as yet abounding with crude Juices, is only inkindled by parts: and therefore burns out a little, and then ceases, and at last returns; like a flame that is made by wet, and moist straw. In this condition for some days, the Disease remains, the Urine is more red than usual, by reason of the Salt, and Sulphur being more dissolved, and infected with the *serum*; It still retains its Hypostasis or substance, because the Coction and assimilation are not altogether depraved; it appears greater than ordinary, in its sediment, which is yet easily separated, and falls to the bottom of its own accord. At this time, they may let Blood, and administer Physick by Vomit, or Purge, so it be done without any great perturbation of the Blood: it often happens, from these kinds of evacuations, timely performed, that a greater increase of the Disease is prevented, and the Feaver as it were killed in the shell. The limits of this stadium or space, are variously determined, according to the temper of the sick, and other accidents of the Disease; sometimes, the first rudiments of this Feaver, are laid in a day or two; sometimes the beginning of the Disease is extended to more; if in a corpulent Body full of Spirit, Juice, and hot Blood, or it happen in a youthful Age, and very hot season, if the disposition to a Feaver be potent, and the evident cause coming thereupon be strong, the Feaverish heat, being once begun, quickly invades all the Blood, and on the second or third day, having rooted it self, the Disease arises to its increase; but if the Feaverish indisposition, be begun in a less hot Body, a Phlegmatic temper, or a melancholy, and in old age, or a cold season, the entrance is longer, and scarce exceeds the limits of this first stadium or space, before the sixth, or seventh day.

2. The increase of this Disease, is computed from what time, the burning of the Feaver hath possess the whole mass of Blood: that is, the Sulphur, or the oily part of the Blood, having been long heated, and growing fervent in parts, at length, like Hay laid up wet, breaks forth, after a long heating, all at once into a flame; the Blood at this time cruelly boils up, and very much inkindled in the Heart, by its deflagration, diffuses as it were a fiery heat thorow the whole Body, and especially in the precordia; hence the sick complain of intolerable thirst, besides a pain of the head, pertinacious wakings, and oftentimes a delirium, Phrensie, and Convulsive motions infest: all food whatsoever is loathsome, either it is cast up again by Vomit, or if retained, being baked by too much heat, it goes into a Feaverish matter; besides, there happens a bitterness of the mouth, an ingrateful favor, a scurfiness of the Tongue, a vehement and quick Pulse, an Urine highly red, and for the most part troubled, full of Contents, without Hypostasis or laudable sediment; when the Blood is at this time almost wholly inkindled by its deflagration, it begets great plenty of adust matter, (as it were ashes remaining after a Fire) with which the *serum* being very much stuffed, renders the Urine thick, and big with Contents: Also the Blood, being filled with a load of this, to arising up, is irritated into Critical motions, by which this Feaverish matter, (if it may be done) being brought under, and separated, is shut out of doors; and indeed, this state of the Feaver induces that, in which a Judgment is discerned, between Nature and the Disease, the strife being as it were brought to an æquilibrium; and therefore the evacuation, which follows from thence, is called the Crisis.

The state therefore, or height of a putrid Feaver, is that time of the Disease, in which Nature endeavors a Crisis, or an expulsion of the adust matter, remaining after the deflagration of the Blood. To this is required, in the first place, that the Blood hath now for the most part burned forth; because in the midst of its burning, Nature is not at leisure for a Crisis, nor is it ever prosperously endeavored, nor in truth procured by Art with good Success. Secondly, that the spirit of the Blood, doth first, by some means subdue this adust matter, or *Caput mortuum*, separate it from the profitable, and render a period to the expulsion, for otherways, tho a copious evacuation happens, Nature

Nature will never be free from her burthen. Thirdly, that this matter, be gathered together in such a quantity, that by its turgency, it may irritate Nature to a Critical expulsion. If these rightly concur, a perfect Crisis of the Disease, for the most part succeeds, in which, even as in the Fits of intermitting Feavers, a Flux being arisen, whatsoever extraneous and heterogeneous thing, is contained in the bosom of the Blood, is exagitated, then being separated, and involved with *serum*, it is thrust forth of doors; when any thing of these is wanting, the Crisis, for the most part, is in vain, and not to be trusted, and rarely cures the Disease. For if in the midst of the burning, before the Blood hath sufficiently burned forth, an evacuation happens, by Sweat, a Lask, Bleeding, or any other way, the adust matter is not all separated, or else, if for the present, it be drawn away for the greatest part, the Blood more largely flaming out, presently substitutes new, and will renew the Feaver again, that seemed to be vanquished: If that this matter, not being yet overcome, nor brought to a fulness of rising up, be irritated to an expulsion by Nature, an imperfect, and partial Crisis only follows; and when the first endeavor of excretion shall be in vain, rarely a perfect, and curatory succeeds after that one time.

The Crisis in a continual Feaver, is almost the same thing, as the Fit of the intermitting Feavers. For as in this, when the mass of Blood, is filled to a fulness of swelling up, with the particles of depraved alible Juice, and fitted for maturation, there are made a Flux, secretion, and expulsion out of doors of that matter: so in a continual Feaver, from the deflagration of the Blood, and alible Juice, very many little Bodies of adust matter are gathered together, with which, when the Blood is aggravated, and is at leisure, a little from the burning, it overcomes them, by little and little separates them, and then a Flux being raised up, endeavors to cast them out of doors: wherefore, as the Fits of intermitting Feavers come not but at a set time, and after so many hours, so also the Critical motions, happen from the fourth day to the fourth, or perhaps from the seventh day to the seventh, for in this kind of space, the Blood being inkindled burns forth, and with its burning makes an heap of adust matter, as it were ashes, which being troublesome to Nature by their irritation, induces Critical motions.

Therefore, what some affirm is not true, That the Crises depend altogether on the influences of the Moon, and Stars, and follow their Aspects, Quadrations, Oppositions, or Conjunctions: because the Critical evacuations are only determined, by the gathering together, and the swelling up, of the adust matter. For, as soon as the Blood is at leisure, from the deflagration, and being filled with the particle of that adust matter, is able in some measure to overcome, and separate them, presently a Flux, or swelling up being risen, it endeavors to thrust them forth by any way; which, for that they are easily to be separated from the Blood, and the breathing places of the skin are sufficiently open, being involved with *serum*, are sent away with sweat. And this is the best way of the Crisis, which if it rightly succeeds, very often, wholly, and at one time, perfectly cures the Disease without danger of relapse: To this next, follows the Crisis, which is endeavored by the Hemorrhage or bleeding at nose; for this matter, as it were the flowring, being moved with the Blood, (if it be not cast forth by sweat, by reason of a less free transpiration) is transferred from the heart, into some remote part, and frequently is cast into the head, by the impetuous rapture of the Blood; where, if a passage be open, from the private holes opening into the nostrils, the morbid matter, leaps forth of doors, with a portion of the Blood. But otherways being oftentimes fixed in the Brain, brings a phrensie, delirium, or other grievous, and tedious Diseases of the head; yea, tis to be observed, that almost in all continual Feavers whatsoever, when they are hardly or imperfectly cured, so that the Blood is infected, for a long time with the Feaverish matter or adust recrements, that from thence, the nervous Juice (as it seems) contracting an infection, pertinacious distempers, to wit, watchings, also Deliriums, Tremblings, Convulsive motions, and long adhering weakness of the nervous parts follow. Also, there are other ways of Crisis, by which Nature endeavors, not at once and wholly, but by little and little, and by parts, to expel the Feaverish matter; now by Urine, now by Vomit, or Stool, now by breakings forth, and buboes, or biles; by what way soever, that it may be done with a good event, it is required, that the deflagration of the Blood be past, and that the adust matter be concocted, and rendered fit to be separated.

The state or standing of the Disease, is therefore not one, and simple, nor always happens after the same manner, but with a various difference of symptoms, and tending to far different events. But by a prudent Physician, a Prognostication is expedient to be given, in what space of time, the Disease will come to its height or standing, and what end it will have.

If the Feaver be vehement from the beginning, and suddenly invades the whole mass of Blood with a burning; if it urges constantly, and equally without any remission, with a ferocity of symptoms; for the most part, the Blood will so much burn forth, in the space of four days, that the adust matter, will arise to a fulness of swelling up, for the making a Crisis. But if its beginnings are more slow, and the accension of the Blood often interrupted, the Feaver will come to its *acme* or height, about the seventh day. If it should begin yet more remiss, the standing of the Disease is wont to be drawn out, to the Eleventh or Fourteenth day. In the mean time it is to be noted, that as the Fits of intermitting Feavers return at set times, so the Critical motions in continual Feavers, (but for the most part they observe the fourth day:) for altho the Crisis may be perfectly prorogued to the fourteenth, seventeenth, or perhaps the twentieth day, because all things, requisite to the full curing of the Disease, do not sooner concur; yet in the time betwixt, more light motions happen, by which the Feaverish matter arising leisurely, to an increase, is a little emptied, and as it were cut off by parts, until Nature may be able to enter upon its more full discussion; but when the great provision of the adust matter, in the burning Blood, is heaped up in the Vessels, Nature, unless otherways disturbed, on every fourth day, being tyred with the plenty of matter, tries to shake off part of its burthen by a certain swelling up: wherefore, for the most part, the Critical motions happen on the fourth, seventh, eleventh, and fourteenth days, not by the direction of the Planets, but by reason of the necessity of Nature.

As to the event, whether the Crisis shall be good or not, certain foreknowledges are taken, from the strength of the sick, the Pulse, Urine, and other signs, and concurrence of symptoms: If the sick appear with some strength, the fire of the Feaver urging, hath a strong and equal Pulse, if the Urine be of a moderate consistency with some sediment, with a separation of the Contents, and easily falling to the bottom, if the Disease shall make its progress, without great Vomiting, Watchings, Phrensie, Convulsive motions, and suspicion of malignity, the standing will be laudable, and to be expected with a good Crisis: if the contrary to these happen, *viz.* that presently strength is cast down, and that the sick is obnoxious to frequent Swoonings, Convulsions, a delirium, with a weak intermitting or unequal Pulse, if pertinacious watchings, intollerable thirst, and Vomiting continually infest; if the Urine be thick and troubled, without sediment, or sinking down of the parts, if, the burning yet troubling, Nature is provoked to critical evacuations, a very dangerous state of the Disease is imminent, nor may there be hoped for any thing of good from the Crisis.

Concerning the Crisis of a Putrid Feaver, we will here subjoyn a particular Prognostication, in which, though the things, which from the beginning did appear, might promise a most desired event, a very deadly one is imminent; I have often observed, in a Putrid Feaver, which begins slowly, and with a small burning, if the Urine be red, and when rendred presently troubled, and thick, which is not precipitated, neither by the cold, nor of its own accord, puts down a sediment, and if at the same time, the sick lie for many days without sleep, tho quiet, and that they toss not themselves up and down, their condition is in danger: and the suspicion will be more, if in the mean time, they are neither troubled with a strong Feaver, nor infested with thirst, or with a very troublesom heat; because those distempered after this manner, are incident for the most part, about the state of the Disease, to a delirium, Convulsive motions, and oftentimes fall into madness, from which they are quickly cast into death; and when these symptoms arise, the Urine is altered, from a thick and red, into a thin and more pale Urine. It seems in this case, the mass of Blood, being taken with the Feaver, not to grow turgid, so with Sulphur exalted to the height, as Wines or Beer are wont in their Effervescencies; but (the Salt, and the terrestrial Lee or Dregs, being stirred together with the Sulphur) to be affected after the same way, as Wines and Beer, being suddenly disturbed with Thunder, and growing sour; wherefore, altho the Blood does not presently conceive an immoderate heat from the Feaver, yet its disposition being changed, it wholly depraves the Juice destinated to the Brain, and Nervous parts, and therefore, about the beginning of the Feaver, pertinacious watch-

ings happen, then the state growing urgent, the œconomy of the whole Nervous stock is perverted. Melancholic persons are most obnoxious to these sort of Feavers, in whom the unruliness of the Sulphur, are a little restrained, by the Salt, and Earthy dregs being stirred up with it, notwithstanding which, all being leisurely carried forth, break forth afterwards, with a greater slaughter.

When the Disease shall come to the standing, either the business is done at one conflict, and from thence with a manifest declination, there is made a translation to life, or death, or there are made frequent skirmishes, between Nature and the Disease, and critical motions are often attempted, before the victory is yielded to either party.

1. As to the first, If after the Blood hath sufficiently burned forth, with a good precursion of signs and symptoms, and its burning hath remitted, the adust matter being equally brought under, and subtilated, arises from a full increase, to the motion of boiling up; and Nature being free from any impediment or depression, is strong with able strength enough, for the decertation or strife, the Feaverish matter, for the most part, is exterminated at one motion of its flowing or putting forth, and the Blood being freed from its fellowship and infection, soon recovers its former vigour.

2. But if Nature is stirred up, to a critical motion, before the Blood hath perfectly burnt forth, or that adust matter is prepared for excretion, altho, as to the rest, things are in a moderate condition; yet from hence, but an imperfect Crisis follows, by which indeed, something of the load or burthen, with which the Blood is oppressed, is drawn away; notwithstanding presently another springs up afresh, in its place, and then at set times, (perhaps in four, or seven days space) like the fits of intermitting Feavers, the critical motions are repeated, the second, and perhaps the third time, before the strife being ended, the matter openly inclines to this, or that party.

3. But when, with the preceeding evil appearance, of signs and symptoms, the burning of the Blood yet urging, the critical motion is provoked, without any coction of the Feaverish matter, sometimes Nature is overthrown at the first conflict, nor doth she recollect herself, but yielding her powers overcome by the Disease, is precipitated into death. Nor is the business much better, when the Crisis is at first imperfect, and in vain, celebrated, without any ease to the sick, and from thence, the next to this succeeds worse, and then in another, and perhaps another conflict, the Disease prevails; until the strength being wholly broken, and cast down, there is a plain end of life.

Thus much concerning the state and Crisis of the Disease, on whose good or improper success, the event of the Disease depends; the declination of the Feaver, takes its period of this, of which we must speak next.

4. Altho the Declining of the Feaver, for the most part, is taken in the better part, that it denotes the condition of the sick growing well of the Disease, in which the Blood being almost freed from its Effervency, recovers leisurely, strength and spirits, that were lost, and expels what extraneous thing is left remaining in its bosom; yet, in a genuine enough signification, it may be used for that state, when from an ill Crisis, or in vain, the Blood being depauperated, and infected with an extraneous and Feaverish mixture, still declines for the worse, until at length (like Wine changed into a lifelessness) being made wholly unable for circulation, and accension in the Heart, it calls on death. Therefore, in this place, the name of declination signifies the condition of the sick, and of the Disease, which follows the standing, whether it tends to life, or to death; whether the Feaver, or life it self of the sick, at this time, declines.

As to the times of declination, it will be worth our labour to inquire, what the temper of the Blood may be, and what turns of alterations it has undergone, as often as from a good, or bad Crisis, there has been made a progress of the Disease, towards Health, or Death. To wit, first, what the disposition, or condition of the Blood and Spirits may be, from a good Crisis, and with what alterations, its spoiled Liquor recovers its former vigor. Secondly, what their temper is, from an evil Crisis, and by what degrees it still tends to worse; and lastly, how they are, when from a doubtful state, and long weakness, the sick hardly get up at length, and recover their health.

The vice, or depauperation, which the Blood hath contracted from the Feaverish heat, consists in this: The Spirit very much evaporates, and is lost: the Sulphureous part is too much scorched, and is much wasted by the deflagration, and from its burning, the adust matter (as it were the *Caput Mortuum*) is left, with the Particles of which, the mass of Blood is aggravated, and debilitated; in the mean time, the Saline and earthy parts, are too much exalted, even as is wont to come to pass in Wine, or Beer, by the use of too much Ferment. The Blood, by these ways being spoiled,
evilly

evilly assimilates the provision of the Nutritious Juice, yea also, by reason of the roasting of the Sulphur in the Heart, or defect of it, not rightly Fermenting, or inflamed, it untowardly dispenses the Vital Spirit, in the mean time, from the adust matter, and Salt too much exalted, it grows more fervent than it should, and more waists it self.

1. From a good Crisis, the Spirit, tho made weaker, yet gets the upper hand, wherefore, what is left of the Feaverish matter, it by degrees overcomes, and expels; and concocts, and assimilates (so what is brought be thin or slender) the Nutritious Juice: from thence, the mass of Blood is amended anew, with Spirit and Sulphur; and the Blood which now being Salt and sharp, did continually grow hot, acquires at length a Sweet and Balsamic Nature, and being quickned with a lively motion and heat, rightly performs the offices of life and sense.

2. From a bad Crisis, the business is otherways, the Liquor of the Blood (like Wine too much Fermented) degenerates, almost into a vappidness or lifelessness; its Spirit is greatly deminished; the Reliques which remain, are intricated, and as it were overwhelmed, with the Particles of adust matter, from whence there is yet a continual growing hot remaining in the Blood, yet without concoction, or assimilation, of the Alible Juice, or separation of the profitable, from the unprofitable: The benign Sulphur, and the Food of the Vital flame, is much consumed, so that the Blood is less inkindled in the Heart, than it ought to be; in the mean time; from the adust recrements, and also the Salt, and Earth being too much carried forth, it perpetually burns in the Vessels, with thirst and heat. And because it is dayly depauperated, the Spirit and benign Sulphur being wasted, and more infected, with the Salt, and Earthy dregs being too much exalted, its Liquor in a short time becomes tasteless, and is made unfit for circulation, and for the inkindling in the Heart, for the sustaining the Vital fire: wherefore there is a necessity that life be lost, even as the flame of a Lamp is extinguished, when instead of the wasted Oil, a Salt and Muddy Liquor only supplies it.

3. From an imperfect and doubtful Crisis, when the sick being weakned by a long imbecillity, become not well, but of a long time, the business is after this manner. The Spirituous and Sulphureous parts of the Blood, are very much consumed, by the slow deflagration; the remaining Liquor, being not Purged from the adust recrements and feculencies, is rendred very impure; but when there is yet remaining, something of Oil for the Vital Lamp, nor Spirits are altogether wanting, for the subduing the Feaverish matter, the Blood is still circulated, and (tho but finally) is inkindled in the Heart: yea, and by little and little the Spirits recollect themselves, set upon the matter remaining of the Feaver, and what they are able, begin to overcome it: then by a pertinacious assiduity, of coction, like a flame, wavering and half extinct, among green wood, at length rise up victorious, and restore anew, both with heat and motion, leisurely renewed, a quick and lively Fermentation, in the Heart.

So much in general of the Feaver called Putrid: it remains, before we descend to the kinds, and particular Cases of it, that I recount the symptoms, and signs chiefly notable, in the course of this Feaver, and subjoyn the reasons, and causes of them, and their manner of being done.

C H A P. X.

Of the Symptoms, and Signs chiefly to be noted, in a Putrid Feaver.

TH E Symptoms, coming upon a Putrid Feaver, altho they argue, the œconomy of the whole Body, to be for the most part depraved, and the disposition, and functions of some part, or Member hurt; yet, the accidents, which a Physician ought chiefly to consider, about the Diagnosis of this Disease, and its Prognosis to be rightly instituted, may be referred to three cases or common places; to wit, they have respect to the Viscera of Concoction, viz. the Ventricle, and In-

testines, with their Appendixes: Or secondly, to the humours, flowing in the Vessels, *viz.* the Blood in the Arteries and Veins, and the thin Liquor in the Nervous parts, together with the chief springs of either, *viz.* the Heart, and Brain; or lastly, these symptoms respect the habit of the Body, with the various constitution of the pores, and the extension or emaceration of the solid parts. They, who would exactly observe, the course of this Disease, and would fitly draw out Curatory intentions, may take notice of these three heads of symptoms, and carefully consider, what alterations may happen in these, as it were distinct Regions, according to the different times of the Feaver.

1. Troubles, and disorders, such as nauseousness, vomiting, want of Appetite, indigestion, a looseness, a scurfiness of the Mouth and Tongue, a bitter savour, are wont to infest about the Ventricle, and first passages, in the whole course of this Feaver. These, for the most part, are attributed to the humors, first heaped together in the Stomach, and there putrifying: But besides, that the recrements of the Chyle, being thoroughly roasted, by too much heat, degenerate into an hurtful matter, very often, these kind of accidents happen, for that the Purgings, and the filth of the Blood, and Nervous Juice, whilst they grow hot, are carried inward, and being deposited in the membranes of the Viscera, provoke Convulsions, and also make a filthy heap of vitious, and very infectious humor. I have often observed, that about the beginning of the Feaver, the Blood growing hot, laid aside its recrements even inwardly, with a benefit to the sick, where, altho great molestations did arise about the first passages, yet the burning was therefore more mild, the Pulse moderate, and the Urine laudable, and these being after this manner in a Feaver, quickly grew well, with a slender diet, and the use of gentle evacuations. But if in this case I should administer a vehement Cathartic, for the extirpating the humours, that Natural Purging of the Blood being hindered, presently the Feaver became strong, with a red Urine, and troubled, a deep Pulse, Watchings, and other horrid symptoms: also, oftentimes after the state of the Disease, by this kind of interior Lustration or Purging, the adust matter, and excrementitious, is separated from the Blood. Hence, sometimes a Lask, sometimes a scurfe covering of the Mouth and Throat, follow: Wherefore, there is need of caution, about the accidents which happen in the first passages, lest that whilst we oppose them, we should pervert the motion of Nature; and lest whilst we fortifie these parts, against the course of the Morbific matter, we untowardly keep the same shut up, in the mass of Blood.

The Symptom chiefly to be considered, about the Bloody mass, are, an heat diffused through the whole, a burning of the Præcordia, thirst, a disorder of the Pulse, a red urine, a spontaneous wearisomness, a loss of all strength, out of which rightly considered, these things following may be known, *viz.* what the manner of the heat is, or with what tenour the burning Blood flames forth; what times of remission, or of increase, its Effervescency observes, in the deflagration; whether it retains its Crasis, or mixture whole; for the burning of it, and circulation of it inkindled, what strength of the Heart will suffice, and what space the Vessels may require; so long as the Blood burns, what plenty of adust recrements it may heap up, by what means it may overcome, separate, or at least endeavour to separate the same, and lastly, what way of a Crisis it endeavours, and with what success.

The accidents, which have a respect to the thin Liquor, with the Brain, and Nervous Appendix, are, disorders concerning sleep and waking, a debility of the whole Body, a trembling, shivering, pains, Convulsive motions, Cramps of the Viscera, Stupifaction, Phrensie; and the observation of which suggests, what the temper, and constitution of that thin Liquor may be; by what means it waters, and influtes the Nervous parts, and performs its circuits through them; how the Animal Spirits execute the functions of the Viscera; what the state of the Brain may be, whether it remain free from the incursion of the Feaverish matter, or whether it be not in danger of being overwhelmed, by reason of its critical metastasis or translation.

Concerning the habit of the body may be observed, what may be the reason of sweating, and the manner of it; whether only by vaporous *Effluvia*? or by sweats? or also by little wealks! whether the flesh falls away on the sudden from its wonted bulk? Or whether it retains it self a long while? What the colour of the Face is! And the vigor or habit of the Eyes? from these well laid together, the course of the Feaver may be best of all measured; at what time it will come to its hight or standing? Whether Nature will prevail over the Disease or not; with what manner of separation,

paration, and with what success she will endeavor the expulsion of the Feaverish matter; also by these signs may be learned, by what degrees the Blood growing hot, and often congealed, doth tend towards Putrefaction, or Corruption; whether it does any thing concoct the alible Juice poured to it; or whether or not it presently casts forth of doors, all its provision by sweat, as often happens in the declination of this Disease.

By these symptoms and signs, a yet more plentiful Indication may be had, if first it be known, upon what causes the several species of them depend; and by what provision, they are wont to be raised up in our Body: wherefore I have thought it worth our labour to recount particularly the chief of these; and to explicate the reasons of them, and their ways of working. But the symptoms, chiefly to be observed in a putrid Synochus, or continual fervor without intermissions, are, an heat in the whole Body, a spontaneous weariness, a burning of the Præcordia, intolerable thirst, an ardor, and scurfiness of the Tongue, or Jawes, a pain of the head and loins, pertinacious watchings, Phrensie, Convulsive motions, a Syncope, Heart-burning, Vomiting, Nauseousness, want of Appetite, a Loosness, a Flux, with which, not all at once, now with these, now with those, this Disease is wont to be beset.

1. Heat, which is felt sharp and biting, in the whole Body, depends upon the too great effervency of the Blood, and the accension of it in the Heart: For the Sulphureous or oily part of the Blood, being exalted, and taking an heat, is inkindled in the heart, in a double proportion, more than it was wont; wherefore, it copiously diffuses, by its deflagration, *effluvia* of heat thorow the whole Body. When the Sulphur is less dissolved, and inkindled in the heart, as in the green sickness, or the white dropical Disease, &c. Heat is wanting in the whole: but in a Feaver, when the Sulphur too much burns forth, Heat superabounds. For heat, depends not only upon the actual inflammation of the Sulphur, or the firing of it, but an intense heat is excited without fire, in many mixtures, where the particles of Sulphur are dissolved by corrosion, or are more thickly heaped together for want of ventilation; wherefore, when Iron is corroded by any acid mineral Spirit, or when Spirit of Nitre is poured on the butter of Antimony, a mighty heat with a fume is produced; in like manner when Dung, or Hay laid up wet, are kept from ventilation, grow highly hot: it is the same reason, why the Blood burns above measure in Feavers, to wit, the particles of the Sulphur, being too much exalted and made hot, are more thickly heaped together in the Vessels, and are more dissolved, and as it were inkindled by the ferment of the Heart; wherefore, they every way diffuse heat, being loosened in the bond of the mixture, and every where stretched forth or expanded.

2. A spontaneous weariness or lassitude, is felt in the whole Body: to wit, by reason of the Vessels being distended with the boiling Blood, also the musculous flesh is very much stuffed with Blood, and a copious breath, that it is made less fit for motion, as they who are sick of an Anasarca, have their limbs very unwealdy by reason of the abundance of serous humor: besides, in Feavers, by reason of the inflammation of the Blood, the Juice, which is sent for a supply to the nervous stock, departs from its due temper, that it becomes little fit, for the actuating the Body.

3. The burning of the Præcordia is made, by reason of the Blood being more copiously enkindled in the Chimny of the Heart, which from thence boiles forth into the Lungs, with great ardency; wherefore, by how much the neerer this Region is to that fire place of heat, it is pierced therefore with the greater burning.

4. An almost unquenchable Thirst is caused, both from the glowing heat in the Præcordia, also by reason of the sharp and hot particles of the Feaverish matter, affixed to the ventricle, in the circulating of the Blood; which indeed, desire to be washed, even as salted and spiced meats, being plentifully eaten, or also strong, or sour things, roured in the mouth, or throat; for this kind of distemper, calls for a more free swallowing down of Drink, as a member too much heated, the pouring on of cold water.

5. The ardor, and scurfiness of the Tongue, and Jawes, as also oftentimes an accretion of a certain white, or yellow, or black filth, happen without doubt, because of the heat, and soot, exhaled from the Ventricle, and Lungs, burning with heat: but the Tongue grows white, as often as that humidity, (with which it is naturally much imbued) is dried up, and parched, and so the exterior skin of the Tongue, is as it were roasted, by the burning heat, from hence also it becomes scurfie; which is also seen in healthful people, when it happens, that the Tongue is scorched by broth, or any other very hot supplings; in like manner, as when the Tongues of Animals are boiled, for the use of the Table, their skin becomes white and sharp or rugged. For whether the
spittle

spittle is drawn from the maxillary glandulas, (as the doctrine of the most ingenious *Wharton* hath first made known) or any other humor from the glandulas of the Jawes, or elsewhere ; yet because, by the reason of the heat, and dryness, it grows too thick, and becomes clammy, also then the outward skin of the Tongue grows nevertheless white ; but also it is covered with a certain filthy glew, to wit, because that humor, by reason of its thickness, may smear the Tongue, but cannot wet, or moisten it : but if it happens, that the Tongue is inwardly suffused, with a bilous humor, or outwardly tinged (as comes to pass by the use of Choler-abounding Vomits) then its hairy nap, being spongy, imbibing the yellow poyson, exhibits also the like colour. If that lastly, the heat be so strong, that it burns the Blood, and inkindles a fire, more ardent than usual, it follows, that from the fire place of the Heart, the breathing places through the Lungs, scarcely sufficing for the ventilating so great fire, soot or smoak is raised up, which being smitten to the furnace of the Pallat, strikes against the Tongue, as it were in a reverberatory, and infects it with blackness. But this same kind of blackness, (and as other filthinesses of the Tongue) is most conspicuous in its middle parts, because the more exterior compass, is cleansed by its frequent rubbing against the gums and palate.

6. Sometimes it happens in Feavers, and especially about their declinations, that the Tongue, palat, gums, yea the cavity of the whole mouth, and throat, are covered over with a certain viscous matter, as it were a whitish crust ; which being often wiped off, presently new springs again, and unless by rubbing diligently, and washing the mouth, this crusty matter be frequently wiped away, the sick are in hazard of being choaked. This kind of distemper, is most often excited in Children newly born ; for they are wont, for the most part, within fourteen days with an external growing hot, to be sprinkled thorow the whole skin, with broad and red spots ; if that this suffusion of redness, do not freely break forth, or vanishes away sooner than it ought, for the most part, this whitish crust follows, in the parts of the mouth. This symptom, when it troubles Infants, after this manner, is wont to be ascribed to the fault of the Milk, to wit, that being too sharp, it induces the ulcerous distemper of the mouth. In those sick with Feavers, it is commonly attributed to thick vapors, and sootie, elevated from the ventricle : But to me it seems most likely, that in either, this distemper arises, from the impurities of the whole Blood, (and perhaps in some measure of the nervous Juice) deposited about these parts : for, as often as in the mass of either humor, any extraneous thing intimately mixed, is contained, that it is not to be dispersed by sweat, nor easily sent away by Urine, that, most often, is fixed, with the serous filth about the mouth ; from whence Catarrhs, tumors, and troublesome spittings are caused : For when for the chewing of the meats, the salival humor in this place ought to be plentifully suffused ; nature very often endeavors to send forth of doors, what is superfluous, or otherways troublesome, by these usual ways of excretion. Hence from *Mercury* being taken, when both the Blood, and nervous Juice, are abundantly stuffed, with its most finely divided particles, and endeavor to thrust them forth, being involved with *serum*, because they are not able to exterminate those mercurial little Bodies, being intimately confused, neither by sweat, urine, or by any other ways, what is remaining, they endeavor to expel thorow the Arteries, and other passages, which supply the mouth with spittle, the same being involved with the serous Latex. Also in like manner, in Feavers, when from a long deflagration of the Blood, the adust matter is very much heaped together, of which no small part remaining, after the Crisis, is yet confounded with the Blood, and nervous Juice, being fixed either to the brain, or to some other place, from them it is at length supped up again, 'tis most probable, that this matter, is thoroughly roasted, by a long concoction, and so becomes almost like Glew, thick, wherefore, being not able to be dispersed, neither by spittle, or insensible transpiration, nor to be separated by the urinarie passages, but at length leisurely runs out, by the little Arteries, and other passages of the spittle, lying open into the Palat, as the most usual way of excretion, and forthwith by reason of its thickness grows into that glewiness. The same reason holds in Infants, whose Blood being made impure, by filths contracted in the Womb, presently it endeavors to purifie itself, by that exterior putting forth, which if it do not rightly succeed, by reason of the thickness of the matter, immediatly the viscous impurities, are exterminated by this way, as the more open. I have known some, in the declination of a Fever, to whom, not only this kind of Crust of gummy matter, has hapned in the parts of the mouth, but a copious salivation, as if they had taken mercury, with a stinking of the breath, also

also a swelling of the Tongue, and Gums, hath been raised up for many days.

7. The pain of the Head, in Feavers is excited, because of the Meninges of the Brain, being pulled or hauled with vapors, and with a sharp Blood, and hot; for the Blood being impetuously moved, by reason of the direction of the great Arterie, is carried in a greater plenty to the Head, than to the lower parts; because the passage, from the bosom of the Heart to the head, is strait, from the same, to the inferior members, oblique, and as it were reflected; wherefore, as the membranes are very sensible, and that there the Blood is stopped, and reverberated, in its rapid course, it is no wonder, if cruel headaches are excited in Feavers. Besides, this impetuous flowing of the Blood, wherewith (as it were by a certain Ramming) the membranes of the Head being distended, ake grievously; also sometime, Headaches arise, by reason of the nervous Juice, (which is supplied from the burning Blood) being too sharp, and pricking: wherefore, when the membranes, and nervous parts, are watered, with the same, they being pulled by its acrimony, are moved into Pains and Convulsions.

8. In like manner also, the other distempers of the Head, as watchings, delirium, Phrensie, Convulsion, &c. arise, sometimes from the Blood being in a rage, and so stirring up inordinate motions in the Brain, and sometimes also, from the nervous Juice being depraved, and therefore made impropportionate, to the regiment of the Animal Spirits: But most often, these kind of symptoms are frequent in Feavers, by reason of the translation of the Feaverish matter, from the bosom of the Blood, into these parts. For the Blood, being full of the adust recrements, remaining after the desagratiſon, endeavors (like the flowing of new Wine) to subdue, and exclude them from its Company, by every manner of way; which, a Flux being arisen, when it cannot expel by Sweat, Urine, or bleeding, it oftentimes transfers, to the substance of the Brain, and there fixes them: and from hence chiefly, the aforesaid distempers, when they are fixed, and firmly rooted, draw their original, when as the lighter, and that are easily moved, often proceed from the afore-recited causes.

9. Convulsive motions, happen in Feavers, for divers causes: sometimes, because of the matter being heaped together in the first passages, which there hauls the membranous parts, with its notable pravity, and then, by the consent of the nervous stock, the Convulsion is presently Communicated to the beginning of the Nerves, in the Brain, and by that means draws aside now these, and now those parts: by which means, Worms abounding in the Viscera, sharp humors being stirred, and strong Medicines, induce Convulsions: or secondly, when the Feaver, is a partaker of some malignity, so in the small Pox, Measels, or the Plague, frequently Convulsions happen; to wit, because the Blood is altered, from its benign and natural temper, into a destroying and venomous, by which the Nerves, and their beginnings, are pierced, and forced into Convulsions. Also, oftentimes without the suspicion of malignity, in a putrid Feaver, Convulsive motions are induced, by reason of the translation of the Feaverish matter, to the Brain, as was but now intimated: so I have often observed, when the Disease is not presently cured with the Crisis, the sick ly by it, with a tedious sickness, and are made obnoxious to tremblings, and Convulsive motions. Thirdly, and lastly, for the most part in every Feaver, which terminates in Death, Convulsive motions are the sad forerunners of it; which I think to happen, not only from the malignity of the matter, with which the nervous stock is pulled and pierced, but because the Spirits, very much exhausted and debilitated, do not sufficiently blow up, and distend the Bodies of the Nerves, wherefore, being released from their wonted extension, and tonick motion, they are however by a more weak endeavor of the Spirits, agitated into a disordered motion.

10. A syncope or swooning, is wont to be raised up several ways in Feavers, but chiefly for these three causes, to wit, either from the mouth of the Ventricle being distempered, which part, as it is interwoven with a manifold texture of Nerves, is very sensible, and because from the same branch of the sixth pare, little shoots of Nerves, are equally derived to the heart, and to the Ventricle, of the Orifice of the Ventricle, so implanted with Nerves, be distempered, with any great trouble, it is also Communicated to the heart, and either the motion is stopped in it, or at least an inordinate one is excited, whereby the equal Flux of the Spirits, and the Blood, is interrupted for a time. I knew one in an acute Feaver, taken with a frequent swooning, which distemper wholly ceased, after he had cast forth by Vomit, a long and smooth Worm. Secondly, a syncope also, is sometimes induced, because the invenomed matter is circulated

lated with the Blood, which suddenly fixes, and extinguishes the vital Spirits, and congeals the Blood it self, that it is apt to stagnate in the heart, as usually happens in the Pest, small Pox, &c. of which we shall speak particularly hereafter. Thirdly, a syncope is wont to happen, by reason of the more rare texture of the Spirits, which as they are very tender and subtil, are easily unbent, by any immoderate motion or pain: so I have known some, who being quiet in bed, have found themselves well enough, but being removed from one place to another, presently have swooned away.

11. The pain of the Heart happens in Feavers, when the Ventricle, and especially its Orifices, by reason of the manifold insertions of Nerves, being very sensible, are beset with a sharp and bitterish humor, or else with an acid, and corrosive; for hence a pain and trouble arises from the acrimony of the humor, after the same manner, as when the sphincter of the fundament is afflicted, in Cholloric dejections, with pain and molestation.

12. By reason of the same cause, Vomiting, and nauseousness are wont to be excited, to wit, by the Ventricles being beset, and irritated to a Convulsion, from an extraneous matter, and not akin to it self: Such an excrementitious matter, may be gathered together in the Ventricle, by three ways; for either the aliments, partly by reason of a want of an acid ferment, by which they should be rightly Cooked, and partly by reason of the burning heat of the Ventricle, are roasted into such a Corruption; or Secondly, this kind of matter, is laid up in the Ventricle, from the Arteries, terminating in its Cavity, as uses to happen in the small Pox, the Plague, and malignant Feavers; or Thirdly, meer Choler, being pressed forth from the Choleduct Vessels, into the empty intestine, by reason of an inverse motion, and as it were Convulsive, of that intestine, it is poured into the Ventricle, want of Appetite, also happens, by reason of the Ventricles abounding with vitious Juices, and because the acid ferment, is wholly perverted, by the scorching heat. These kind of distempers of the Ventricle, and Viscera, sometimes arise from an excrementitious matter, (to wit, alimentous, degenerated in the concoction) heaped together, a long while before the Feaver, in the first passages, which not seldom becomes, the occasional cause, of the Feaver it self: but sometimes, nauseousness, want of Appetite, Vomiting, pain of the Heart, &c. are the immediate products of the Feaver; for when the day before the sickness, those distempered, have been well enough in their Stomack, as soon as the immoderate heat of the Blood was induced, whilst it boiled up above measure, both the *Effluvia*, and the recrements, being wonted to be evaporated outwardly, also the bilous humor, flowing out of the Choleduct Vessels, are poured into the Ventricle; by which, its *Crisis* is overthrown; also the Reliques of the Chyle, and other contents in the Viscera, are egregiously depraved; from whence, the aforesaid Distempers draw their Original.

14. No less frequent a symptom in Feavers, is a Diarrhea, or Flux of the Belly, which sometime happens about the begining of the Disease, and arises (for the most part) either from the Bile, flowing forth of the Coleduct Vessels, into the *Duodenum*; or from the recrements of the Blood, and Nervous Juice, poured forth from the Arteries, and the passage of the Pancreas, into the intestines. All the aforesaid humors, (but especially the Choleric) when they are supplied in abundance, often Ferment with the mass remaining of the Chyme, that the same swelling up with a spumous rarefaction, irritates the intestines, and provokes to the motion of excretion: sometimes also, about the standing of the Disease, and in the declination of it, a Lask is excited; and so, either Nature being Conquers, the more thick purgings of the Blood, are this way critically sifted forth; or being overcome, the Flux of the Belly, is the effect, and sign, of the Viscera wholly losing their strength, and firm tenour. It sometimes happens in a Feaver, that the Belly is always bound, that it is not at all loosned, but by Physick, and tho the sick take nothing but liquid things, for many days, the stools are still of a solid consistence, and hard, this seems for the most part to be done, when the Blood growing sharply and exceeding hot, like fire, consumes the humidities, wherever they flow, and draws to it self, out of the Bowels, the watery matter, by a Copious emission of vapours, and presently makes it to be evaporated outwardly: wherefore, the thicker part, being left in the intestines, is made firm, from the scorching heat, as it were a *Caput Mortuum*, remaining after distillation.

A Dyssentery is a distemper, so frequent in continual Feavers, that some years it becomes Epidemical, and not more mild than the Plague, kills many: The cause of it is wont to be, not any humor produced within in the Viscera, that corrodes the intestines

testines with its Acrimony, (as some affirm) but a certain infection impressed on the Blood, and so intimately confused with it, that, under the form of a vapour, or a sincere humor, it cannot be pulled away from the Blood: wherefore, the thrusting forwards, towards the intestines, unlocks the little mouths of the Arteries, and makes there little Ulcers, and exudations or flowings forth of the Blood, like as when from the Feaverish Blood, Pustles and inflammations break forth outwardly, with a flowring towards the skin: But it is most likely, these dysenteric distempers, which accompany Malignant, or Epidemical Feavers, arise from a certain coagulation of the Blood, as shall be more fully declared hereafter.

And here also, among the symptoms of Feavers, might be recited, what are wont to appear outwardly, in the superficies of the Body, as are Spots, Wheelks, Buboës, Carbuncles, &c. but because these belong after an especial manner to a Malignant Feaver, therefore we will forbear in this place, from the consideration of them, until we shall speak of the Plague, Small-pox, the Pestilential, and Malignant Feaver.

The Pulse and Urine shall conclude here the troop of symptoms and signs in a Putrid Feaver, which are much heeded, for the finding out, both the state and the strength of the sick: For, as there are two things, by which our life is propped, *viz.* Heat inkindled in the Heart, and concoction to be made in the Viscera, and Vessels, because the Pulse and Urine, best show the alterations in either, induced in a Feaver, therefore from hence, a most certain judgment is taken of this Disease, about to end, in Death or Health. I think it is not needful, to speak of these at large, or to recount the several causes and differences of either: It will suffice for me to note here, the chiefest things of them, and what are worthy of consideration in the course of Feavers. And first of all the Pulse is consulted, as it were a Thermometer or Weather-Glass, constituted by Nature, that from thence, the heat inkindled, in a Feaver might be meted; which if it should be more strong, stirs up a great ebullition or boiling up of the Blood, the Artery beats more strongly and quicker, so long as the Spirits are in strength; then they being a little exhausted, the more strong Pulse is remitted; which however is compensated with swiftness, and is made quick, and small. If the Feaver be gentler, and is troubled with a lesser burning, the Pulse also declines less, from its Natural condition, and the moderation of this, in the whole course of the Disease, denotes the truces of Nature. Neither doth the Pulse only, betray the forces of the Feaver, as of an Enemy, but shews also plainly the strength of Nature, and her ability of resisting. So long as the Pulse is laudable, the matter goes well, and it shews good hopes; but from the evil state of this, a bad omen is shewn, and a despair of Health. So without a frequent, and diligent examination of the Pulse a Physician cannot make a right judgment or Prognostication, or safely prescribe Physick.

1. As to the first thing, it ought to be known (as much as may be) what every ones Pulse is, according to its Natural Constitution; for it is in these stronger, in those weaker: then it is to be considered, in every moment of the Feavers, by what degrees it is distant from its Natural state: for now it is sometimes more vehement, and argues the Feaver to grow stronger; now it is depressed, below its wont, and denotes the Spirits and Strength dejected.

Those whose Pulse in Health beats weakly and languishing, when taken with a Feaver, if they have a small and weak Pulse, it is not so evil a sign, that we should presently despair of their Health: In whom the Pulse is by Nature strong and vehement, if after the Crisis of the Disease, it hath scarce a moderate vigour, tho it be not wholly weak, it argues the condition of the sick to be suspected, and not safe.

If from the begining of the Feaver, before the Blood has flamed out, or if a Crisis being made, when part of the burthen is drawn away, or at another time, without an evident cause, the Pulse becomes weak, it portends evilly: but if after long watchings, or great evacuations, the Pulse is made a little weaker, Health is not therefore to be despaired of, because the strength cast down by these means, or overwhelmed, may be restored, and the Spirits renewed.

When the Pulse is suddenly altered for the worse tho the sick seem to be better, as to the rest of the symptoms, you may forespeak the sad prognostication of Death; and so contrariwise, altho most horrid symptoms urge, and yet the Pulse is laudable, Health may be yet hoped for. If in a strong man, that hath a Feaver, the Pulse is very small, and creepingly, or becomes like the motion of Ants, death is at hand.

2. In the exhibiting of Medicines, cautions and rules of no small moment are taken; Purging and Vomiting are forbid, by the pulse being too quick and violent; also by being low and depressed; because, whilst the Blood is too fervent, evacuation helps little, because both what is hurtful is not separated, also for that by the perturbation, the strength or spirits, are more debilitated. But when the spirits are broken, and strength cast down, Medicines cast them more down, and sometimes wholly overthrows them. Wherefore, when a Physician thinks of evacuation, upwards or downwards, he first examines the pulse, and goes about this work only, when Nature is strong and quiet; that she may at once be at leisure, for the operation of the Medicine, and may have sufficient strength.

Nor is there less need of circumspection, in sweating Medicines and Cordials: which, if administered in the Feaverish fit, do too much strengthen, the former violent motion of the Heart, and oftentimes break its strength; also, when the Pulse is very languid, if hot and strong Cordials are administered, (as when a small flame is troubled with a more strong blast of wind) life is easily extinguished; wherefore, tis a vulgar observation, that Cordials often accelerate death, for that by too much troubling the Blood, they sooner beat down strength.

There is yet the most need of the caution, and direction of the Pulse, in exhibiting narcoticks; for these, (because they perform their work by extinguishing, and fixing the too fierce vital spirits) if used in a weak or inconstant Pulse, either by diminishing the vital spirits, render them wholly insufficient for the Disease, or by suffocating them too much, cause a perpetual sleep: wherefore, in a languid, unequal, or formicating or creeping Pulse, opiats are to be shun'd, more than a mad Dog or a Snake.

An unequal, and intermitting Pulse, has a most evil report, from the writings of Physicians; yet, altho of an ill note, does not so certainly portend death, as a weak Pulse: for I have known many, to have recovered, tho by those kind of signs condemned to the Grave; because the inordination of the Spirits, and the Blood, may be more certainly and easily composed, or allayed, than their dejection restored.

2. The inspection of Urines in Feavers, before all other Diseases whatsoever, hath more of certainty, and is of greatest use: for from hence, the conditions of the sick, and of the Disease are best known, and the medical intentions, concerning what is to be done, are better directed; what observations, and rules, concerning this thing, are vulgarly set forth, are so many, that it would be almost an infinite labour and tediousness, to recount them all: it will be sufficient here, to note the chief of them.

Concerning the Urines of persons in Feavers, there are chiefly to be considered, the colour, consistency, contents, and subsidency or settling. The colour of the Urine, shews the measure, or excess of heat in the Blood; which, as it is increased, and becomes more remits; the Urine also is more, or less red; the cause of which is, the ebullition of the Blood or the effervescency induced from the Feaver, to the Blood; by reason of which, the particles of Salt, and Sulphur, implanted in the Blood, humors, and solid parts, are more dissolved, and incocted with the *serum*, and impart to it a redness; even as, when Salt of Tartar, and common Sulphur being mixed one with another, and boiled in water, impart a deep red colour to the Liquor.

The Urines of some, are highly red, when they are but a little, or lightly Feaverish: and on the contrary, the Urines of others, labouring with a Feaverish burning, are less coloured. Who abound with lively heat, and a very hot Blood, or are obnoxious to the Scurvy, phthisis, or hypochondriac distemper, when by taking cold, condensation, surfeit, or drinking of Wine, they are troubled by any little Feaver, they render a Urine strongly red: for that the particles of Salt and Sulphur, remain exalted in their Blood, and before half loosened; wherefore, there is a necessity, that the Feaver urging, they are more boiled in the *serum*; on the contrary, they who are indued with a cold temper, with a faint and weak Pulse, being taken with a Feaver, with a greater effervescency of the Blood, render their Urine less coloured.

The consistency, contents, and subsidency of Urines, being put as it were upon the same thrid, depend all of them, on the adust and recrementitious matter, which is remaining in the Blood, after the Feaverish deflagration: if there shall be plenty of this, the consistency of the Urine becomes somewhat thicker, and after it has stood, it is troubled by the cold: but if there be a lesser quantity of this, or otherways derived than to the Reins, (to-wit, by sweat, or is called away by a critical translocation, to this or that part) the consistency is made thinner, and the Liquor remains clear. Also the particles of this matter, do enlarge the contents of the Urine, which shew themselves

selves diversly, according as the nutritious Juice, is now somewhat cooked, and assimilated by the Blood, now altogether perverted, and carried into a putrification, some signs of concoction, and assimilation, shew themselves, in the Urines of Feaverish persons, now a laudable Hypostasis now some marks and rudiments of the same: A want of Hypostasis, and the confusion, and perturbation of the Urine, denote the concoction vitiated, But as this matter is more or less roasted, in the Blood, the contents are now of a pale, now of a red colour, like oker. By reason, that the recrements, confounded with the Blood, either the Spirit being strong, begin to be overcome, and separated, or the same being depressed too much, they are less able to be separated, also the contents of the Urine, are wont to be more or less, sooner or slower separated, from the rest of the Liquor, and to sink down towards the bottom.

As to the Prognosticks, to be taken from the Urine, we may take notice, that the colour of the Urine being somewhat more remiss, the consistency mean, the contents few, and the subsiding free or easily collected into a Cloud, portend good: on the contrary, a deep red, a thick and troubled consistency, thick and cloudy contents, which slowly or scarce at all sink to the bottom, denote a very great heat, plenty of adust matter, and its being brought under, and secretion, difficult or frustrated.

As to the Medicinal directions, the business depends on this, that we attend, by the frequent inspection of the Urine, the motion of Nature, and be helpful to the same; neither is it to be moved, by purge or sweat, but when a certain hypostasis of the Urine shews signs of concoction and separation. I thought it needless to say any more here concerning this matter, because those things are more largely handled elsewhere, in a proper place, which belong to Urines.

C H A P. XI.

Of the Kinds, and Cure of a Putrid Synochus, or continual Feaver.

AND thus much for a Putrid Synochus in general, in which is described its formal reason, according to the accidents and symptoms which are commonly observed in its Figure; there are besides, (I shall not say species but) some varieties, or irregularities of this Disease, in which, this Feaver sometimes declines from this common Rule, and by reason of some accidental Distempers, gets new names and distinctions.

In the first place therefore, a Putrid Synochus is wont to be divided into Symptomack, and essential; It is called Symptomack, which draws its beginning from some other Distemper, or Disease before excited in the Body, so that the Feaver, is only a symptom, coming upon that other Disease: of which sort is accounted, what depends upon the squinancy, plurisie, the inflammation or imposthume of the Lungs, or any imposthume from a wound, or ulcer in a principle part, or its neighbourhood, of which we think a little otherways, *viz.* That truly no Putrid Feaver is merely Symptomackal; perhaps it may arise occasionally, from some other Distemper; but it is founded immediatly, in the Sulphureous part of the Blood being made too hot, and as it were inkindled: for without a Procatarsis, or preceeding indisposition of the Blood, the aforesaid Distempers, rarely, or not at all, cause a Putrid Feaver.

As to what respects the squinancy, plurisie, the inflammation or imposthume of the Lungs, and the like; I say, that these are the products of the Feaver, or Distempers following it; but by no means the cause of it; for most often the evident cause, went before, which produced the Feaverish effervescency of the Blood, as a taking of cold evacuation being hindered. &c. then, altho the sick do not openly grow presently into a Feaver, yet a greater ebullition of the Blood, than was wont, is stirred up, as may be easily conjectured from the Urine, Pulse, and inquietude of the whole Body. After some days, (now sooner, now later) an Inflammation is brought forth, in one part or other; the reason of which, may probable enough be said to be of this sort: The

Blood, by reason of the *effluvia* being retained, (which are like ferment) is increased in its bulk, and grows more turgid than its wont, in the Vessels; and when for want of Ventilation, it is streightned in the space of its circulation, it easily springs forth, where it can find a passage, through the Arteries, and being extravasated, from the broken thred of Circulation, it gathers together into a Tumor: and because from this kind of tumor, an heat, and pain, are increased in the part, the Blood is more disturbed in its motion, and so the Feaver, at first inkindled, is more aggravated.

Further, in these kind of Distempers, we may take notice, of a certain aptitude of the Blood to be coagulated, whereby it is made less fluid, so that it is apt to be congealed in the lesser Vessels: even as it is to be perceived in Milk, when it begins to sour, for then it will not be boiled, nor heated over the fire, without coagulation: and in like manner, there is to be suspected in the Blood, a certain disposition to growing sour, by reason of which, it is made more obnoxious to coagulation; for it easily appears, that in a plurisie, a peripneumonia, the squinancy, and the like Diseases, the inflammation, or extravasation of the Blood, does not always depend on the exuberancy of the Blood, and plenitude of the Vessels: for oftentimes, the Blood is stopped in its motion, with a weak pulse, and a sinking down of the Vessels, and being extravasated in the side, or elsewhere, causes a most acute pain, yea being driven from one part, by and by it is fixed in another: and sometimes it begins to stagnate in the heart it self, and there oftentimes induces a deadly oppression: wherefore, some pluritical people, are wont, when the pains are gone, to complain of a great burthen, and as it were weight, fixed about the region of the Heart: And when we have opened the dead Bodies, of such as have dyed of these kind of Diseases, we have seen the Blood to be gathered together, in little bits, or oblong gobblets, in the secret parts of the Heart, and round about the cavities of the Vessels. But for that these Diseases, are wont to be handled apart from the Feaver, therefore we shall say no more of them here.

It only remains, that we inquire, whether the Feaver which accompanies these Distempers, is to be esteemed in the rank of those, that are called Putrid, or not? To which we reply, that most often, they are simple Feavers, in which only a subtil, and spirituous part of the Blood is inflamed; and therefore, if the extravasated Blood may be restored to circulation, by a plentiful detraction of the Blood, or an emptying the Vessels by sweat, presently the growing hot of the Blood is appeased, and the Feaver shortly allayed. But sometimes, when a predisposition, as in a Plethora, or fulness of good humor, or in a great Cacochymie or fulness of evil Juices, brings it on, together with the same kind of distempers, a Putrid Feaver is inkindled, wholly from the same cause.

Among the symptomatick Feavers, is reckoned that which is commonly called the slow Feaver: they who are sick of this, are more than usually hot, especially after eating, any motion, or exercise; the Urine for the most part is red, the Spirits are feeble; and strength cast down, as to their appetite, and rest, they are indifferently well, they have neither Cough, nor much spitting, but they daily (like those in Consumptions) grow lean, without any evident cause. The fault for the most part is ascribed, to obstructions in some inward, (as the liver, spleen, or mesentery) by whose default, the aliment is not well Cooked, nor rightly dispensed. But it seems to me, that this sort of distemper, is immediatly founded in the evil disposition of the Blood, by which it is inclined, into a too salt and sour temper, and therefore is rendred less apt for nutrition, and an equal circulation. For the Blood in the Heart, just like oil in a Lamp, if it redounds too much with saline Particles, is inkindled not pleasantly, and equally, but with a noise, and great evaporation of the parts; whereby indeed, it is sooner wasted, and exhibits but a languishing, and weak flame. I opened one, sometime since dead of this Disease, in whom the Viscera destinated to concoction, were well enough, but the Lungs were without moisture, and dry, and beset throughout with a sandy matter like Chaulk. Also oftentimes, in this Disease, the Mesentery is beset, the glandules being filled with such a Chaulky matter: But whether the Blood being made more saltish, doth first bring in these kind of distempers of the Viscera, or whether the Dyscrasie, or evil disposition of the Viscera, first brings it upon the Blood is uncertain: it seems probable, that either distemper depends upon the other, and that the causes of either evil are reciprocal.

But the Feaver, which chiefly deserves to be called *Symptomatic*, is that which is excited in Phthisical persons, from an Ulcer, or Consumption of the Lungs. For the whole Blood, whilst it passes thorow the Lungs, in its circulation, often impresses on this

Inward,

Inward, the ideas of very many Diseases; and on the other side, receives the same from it, being evilly affected, whatsoever impure thing is contained in the mass of the Blood, as the flowing of New Wine, is cast forth by extremities of the Arteries, wherefore, when Nature being made more weak, it cannot transfer its recrements into the superficies of the Body, it deposes them, by a more near Purgation into the Lungs. From hence a Cacochymia, or fulness of ill juices, and many Chronical Diseases, end in a Consumption: in like manner, when the flesh of the Lungs waists, or abounding with an Ulcerous matter, becomes half putrid, the Blood passing through it, is infected with the purulent matter, or tabid infection, and for that cause, is stirred up into a continual Effervescency, by reason of the confusion of something not miscible, and wherefore, it induces an assiduous Feaver, and wholly perverts the Alible Juice. The same reason is, of Feavers, form an Ulcer, or Imposthume, oftentimes raised up in other parts: for these, even as the tabid constitution of the Lungs, cause oftentimes a Consumption, and Hectick Feaver. The full consideration of these, are not for this place, wherefore, we will return, whence we have digressed, to a Putrid Feaver properly called, or essential.

The Essential Putrid Synochus, is wont to be divided, into a Putrid (such as is already described) into a Causton, or hot burning Feaver; and besides into a Quotidian, Tertian, and Quartan: The Putrid Synochus, but now delineated, ought to be the rule or square of the rest, to whose type, most Feavers, which are of this kind, are to be composed. As to the rest, but now mentioned, according as they vary their kind, I shall briefly subjoyn.

The Causton, or Burning Feaver, is that which performs its course, with a greater heat, almost intolerable thirst, and other symptoms, arguing a greater inflammation of the Blood: The formal reason of it, by which it is differenced from the rest, consists in this; that the temper of the Blood is hotter, that is, abounds more with fireable Sulphur; therefore, when it grows fervent, it is inkindled in a greater plenty, and with its deflagration, diffuses the *Effluvia* of a most intense heat, through the whole Body: its motion is acute, and quickly comes to its standing, it is compassed about with more horrid symptoms, hath a difficult Crisis, and an even full of danger.

But as to what respects those periods, or fits, in which a Putrid Feaver sometimes is wont to be more cruel, at a set time; and (as if intermitting) now every day, now every third, or fourth day, repeats as it were the Feaverish fit; the reason of this seems not easily to be explicated: especially, if we reject from this cense, the fewer humors, to the spontaneous motion of which, this distemper is commonly ascribed, concerning this matter, what seems most likely to me, I shall doubtingly propose. In a continual Feaver, there are two chief things, (as we have already noted) which for the most part, induce the Effervency of the Blood; to wit, the exaltation and inkindling of the Sulphureous part of the Blood, then consequently, an heaping together of the adult matter, and remaining after the burning of the Blood, to a swelling up: upon the former the continuance of the Feaver, upon the other, its standing, and critical perturbations, depend: to these some times, a certain third thing happens, to wit, a fulness, and swelling up of the crude Juice, from the Aliments newly taken; which in a continual Feaver, (as in the fits of Intermitting Feavers) induces a greater Effervency, at set intervals of times. But why this does not always happen, nor wholly after the same manner, the reason is this: when the Putrid Synochus is very acute, and the whole Blood almost is quickly inflamed, and highly rages, whatsoever of Nutritious Juice, is poured to the Blood, is presently burnt, and consumed by the fire; wherefore, little or nothing of it, is contained in the mass of Blood, for the matter of a fit. But if this Feaver be less acute, and the Blood only flames forth moderately, and in parts, the supplement of the crude Juice, is not wholly consumed, by the burning; but is perverted, by a more gentle fire, into a Fermentative matter, which, when it arises in the Vessels to a fulness of swelling up, conceives a Flux, and by its Effervency, makes stronger the Feaverish heat, before glowing in the Blood, as it were by the coming of new fuel. The flowing of this matter doth not seldom begin with a light shivering, or cold, and sometimes end with sweat: but for the most part, it is exhaled by insensible transpiration. In every fit, besides the provision of the degenerate Nutritious Juice, something from the adult, and burnt matter of the Blood, evaporates; wherefore, the Crisis of the Disease, is drawn forth longer, that tis hardly cured, under eleven or fourteen days; yea (for the most part) in this sort of Feaver, with fits and remissions coming between, the perfect Cure of the Disease happens, scarcely within twenty days: and sometimes leisurely, without any

any through Crisis, it remits, and then, by a long declination, it is ended in Death, or Health.

But that this kind of remission, and acerbation or growing more violent, are varied, according to the type of an Intermitting Fever, that they repeat their turns now every day, now every other day, and sometimes not but within four days, the reason of this is to be sought, from the Doctrine before delivered, of Intermitting Fevers: to wit, that according as the Dyscrasie of the Blood, diversly appears, the suppliment of the degenerate Nutritious Juice, arises to the fulness of swelling up, either sooner or later; and for that reason, its Effervency, causes now more frequent, now more rare fits in this Fever.

Concerning the Cure of Putrid Feavers, of every kind, there are four general intentions, on which, the whole stress of the matter depends. First, that the Blood, (if it may be done) may be defended from burning, and the flame, or fire inkindled in its Sulphureous part, be wholly suppressed; which about the first beginning of this Disease, happens to be often brought about. Secondly, that when the Blood having taken fire, cannot be presently extinguished, that at least it may perform its burning more mildly, and with lesser hurt. Thirdly, the deflagration being ended, that the Liquor of the Blood, be freed from the recrements of the adust and burnt matter, and afterwards restored, to its Natural temper and vigor. Fourthly, that the symptoms chiefly troubling may be timely helped, the which, unless taken away, will frustrate the work both of Nature and Medicine.

As to particular Remedies, with which these intentions may be served, there are various prescriptions, and forms of Medicines, not only among Physicians, but also among old women and Emperics, ordinarily in use: from which however, like a Sword in a blind mans hand, used without difference, and exact method of healing, more hurt than good, most often accrues to the sick. There will be no need here to repeat the forms of Purges, Cordials, and of other Medicines, eligantly enough delivered among many Authors: I will add in few words, some chief indications, and Medical Cautions, which ought to be observed in the course of this Fever, according to its various times, and divers symptoms.

1. At the first beginning of this Disease, the business will be, that the Fever may be presently suppressed; and the inflammation of the heated Sulphur, may be inhibited: to which, the opening of a Vein doth chiefly conduce; for by this means, the Blood is eventilated, and the heated Particles, too much heaped together, and almost ready to be fired, are dissipated one from another: as when Hey, apt to burn, if exposed to the open Air, its firing is prevented. Besides, let a slender diet be instituted, in which nothing Spirituous or Sulphureous ought to be administred; The Viscera, and first passages should be freed from the load of excrementitious matter; wherefore, Clysters are of necessary use; sometimes also Vomits, and gentle Purges; by which, sometimes timely and with judgment administred, the Fever presently after the beginning, is extinguished, the Food of the fire being drawn away. If that notwithstanding this method the burning spreads more abroad, and more and more, dayly snatches hold of the Sulphureous Particles of the Blood; it must be indeavoured, (as much as may be) that the deflagration proceed gently, without great tumult.

2, When the Fever is augmented, if the Blood be too hot, and distends the Vessels very much, with a vehement and strong Pulse; if watchings, a Phrensie, or a pain of the Head cruelly urge, the letting of Blood may be again repeated; Transpiration (as much as may be) should be freely procured, wherefore, let the sick keep in bed, for the most part; let the diet be sparing, of the most slender Aliments, also drink small, and plentiful, that the burning Blood, may be diluted with a more plentiful *Serum*: Clysters are administred safe enough, and in truth commodiously; but Medicines, whether Cathartics, or Diaphoretics, and which too much exagitate the Blood, are to be shunned, with the same industry, as blasts of wind to burning houses: but rather Opiates, and Anodines which fix and bind up the Blood, and Spirits, are to be made use of; also Juleps, and Decoctions, which refrigerate the burning Viscera, attemper the Blood, and cherish the Spirits, are often to be exhibited: acetous Liquors of Vegetables, or Minerals, also putrified Nitre, because they restrain the rage of the Blood, and extinguish Thirst, are truly convenient. Hot waters, and Spirits, Cordial, and Bezoartic powders, (so long as the Disease is not malignant) are not to be meddled with. If that the Blood be unequally circulated, and is carried more towards the Head, than the Feet. Epithemas are profitable, of the warm flesh, or Inwards of Animals, applied to the soles of the Feet.

3. When

When the Feaver is at its standing, the motion of Nature is diligently to be attended, whether it will make a Crisis, or not; Wherefore, nothing rashly is to be attempted by the Physician; the opening a Vein, or strong Purgation, is wholly to be forbid; but after that the Feaverish burning is somewhat remitted, from the deflagration of the Blood, and signs of concoction appear in the Urine, if that the motion of Nature be slow, a Sweat, or gentle Purge may be admitted; which however are better, and safer done, by the Physician, when Nature first, by a critical motion, hath entered upon the scclusion of the Morbific matter. If that all things are crude, and troubled, the Urine yet turbid, without sediment, or separation of parts, if the strength be languishing, the Pulse weak, if there be no Crisis going before, or only in vain, any evacuation, either by Sweat or Purge, is not to be attempted, without manifest danger of life: but it must be longer staid for, that the Spirits of the Blood may recover themselves, may by some means overcome the excrementitious and adust matter, and then by degrees may separate it, and put it forth; in the mean time, the Spirits are to be cherished, with temperate Cordials, the immoderate Effervency of the Blood (if it still be) is to be stopped, and its due Fermentation sustained, which in truth is best performed, by Corals, Pearls, and such kind of powders; which indeed are dissolved by the Ferments of the Viscera, and then Ferment with the Blood, and greatly restore its weak and wavering motion. In the mean time, (whilst Nature is labouring) all obstacles, and impediments are to be removed, and especially the provision of excrements, heaped up in the first passages, is to be brought away, by the frequent use of Clysters.

4 By what way or method, the symptoms chiefly urging, ought to be handled, will not be easily prescribed by certain Rules; because, they themselves require sometimes to be presently appeased, and quieted, and sometimes to be quickned forward: and what is something more, perhaps at another time, they are to be left wholly to Nature. Some of these are too opposed, with gentle and lenitive Remedies, but others with more sharp and irritative Physic: yet in the mean time, it is a precept to be held in all, that you diligently wait upon the footsteps of Nature: which if it works wrongfully, its disorder is to be reduced; if rightly, yet too vehemently, to be bridled: If she works rightly, yet too slowly, or more weakly than she should, the business will be, that her endeavour may be incited, and helped, by the help of Medicine.

5. In the declination of the Feaver, when after a perfect Crisis, Nature is stronger than the Disease, the business goes well, nor is there much business left for a Physician: It only remains, to propose an exact manner of diet, that the sick may soon recover strength, without fear of relapsing: also it is requisite, to exterminate the Reliques of the Feaverish matter, with a light Purgation. About Diet, they often fall on the Rock of relapsing, *viz.* by the too hasty eating of flesh meats, or more strong Food, the sick relapse into the Feaver: for when the Viscera are weak, and the Aliments (unless very slender) not easily digested, and when also the disposition of the Blood, is weaker, that it does not assimilate the more strong nourishing Juice; if any thing disproportionate is brought to either, the regiment of Nature is again perverted, and all goes ill. Wherefore, those growing well, should for a long time refrain from flesh, and when at length they use it, it should not be unless the Urine shall be like that of healthful people, and no more troubled by the cold: and then indeed it will be safest, to begin with broths made of flesh, and then by degrees, to proceed to more strong Aliments.

6. When from an imperfect Crisis, things are grown doubtful, and remain yet undetermined; then is the Physicians most difficult task: The motions and strength of Nature are carefully to be waited on, whether it begins to prevail on the Disease, or to yield to it: If signs of concoction appear, and that there is strength, a gentle evacuation, and only by leisure, is to be celebrated. In the mean time, the symptoms most urging, are to be succoured, with convenient Remedies, all impediments to be taken away, and strength is to be sustained (as much as may be) with Cordials, and a right manner of living or diet.

7. When from an evil, or no Crisis, all things turn to the worse, and when the Physician almost despair of Curing the Disease, he may predict its event suspected, and much to be feared, But yet, he ought not to trust to a naked Prognostication, to hinder all things else, but that as yet, what is in the Medical Art, should be consulted for Health, tho desperate: Remedies may be administered, to the symptoms most infesting; the Spirits of the Blood almost extinct, may be restored by Cordials. When we despond of Health, life should be prolonged as long as it may, and at least a fair exit procured.

According

According to the various types but now described, of a Putrid Feaver, I might readily add very many Histories of sick people, and particular observations, made about their Cure; for these kind of examples are usually met with in our daily practice, so that they are sufficient to fill a great Volumn; out of these however, with the good leave of the honest Reader, I will briefly propose some few respecting the several kinds of the aforesaid Feaver, by which their Doctrine, and Method of healing them, above delivered, may be illustrated.

A Noble Matron, about fifty years of Age, of a slender habit of Body, little stature, indued with a ruddy Complexion, when on the fifteenth day of *June*, by reason of the Summers heat, she had put on more thin Garments, than she was wont, felt herself ill in the Evening; from thence she was distempered with a nausea, and oppression of her Stomach, she felt wandring pains, troubling her now in her shoulders, now in her back, very thirsty, yet without any immoderate heat: on the second, and third day, almost after the same manner, on the fourth day after a Vomit, *Viz.* of the infusion of *Crocus Metallorum* one Ounce given, she cast forth yellow bile four times, and had three Stools, and seemed to be eased: the night following, she slept something better: but on the next day, the Feaver being thoroughly inkindled, she complained of thirst, a burning of the Præcordia, and of a pain, now in her side, now in her back; presently blood was taken to eight Ounces, her Urine was of a very deep red, thick, and troubled without any Hypostasis, or settling of the Contents, her Pulse unequal, and often intermitting, the following night without sleep: on the sixth day of the Disease, early in the Morning, a small Sweat broke forth, from whence the heat something abated, which in the Evening again grew stronger: on the seventh day, a very acute heat, with thirst, burning, an inordinate and intermitting Pulse, as also with a mighty restlessness, and tossing of the whole Body troubled her, on the eighth the symptoms were somewhat more remiss, also in the Urine, some marks of an Hypostasis; she took that day posset-drink, with Meadow-sweet boiled in it, and sweated plentifully; and was cured of her Feaver. All the time of her sickness, for Food they gave only small Beer, Posset drink, Barly broth, or Grewel, also frequently Clysters; Drink, and a cooling Julep, they gave her at her pleasure.

This Noble Lady, through transpiration being hindered, fell into a Putrid Synochus: the *Effluvia*, wont to be evaporated through the skin, being retained within, (together with the Choler flowing out of the Choleric Vessels) and fixed to the Viscera, did overthrow the dispositions of their parts, and especially gave trouble to the Stomach, and raised up pains and Convulsions, in the parts filled with Muscles and Membranes: the Pulse was unequal, and intermitting, not because of the malignity of the Disease, as in the Plague, but by reason a certain proper disposition of the Heart, by which indeed, its ferment being not well constituted, the Blood growing fervent, is not presently equally inkindled, and wholly leaps forth, but a part of the Blood, in flowing in a small, then a greater, and after some turns the greatest proportion, stopping for a moment of time, in the Bosoms of the Heart, produces the unequal and intermitting Pulse. I have known in many others, clearly, the like distemper of the Pulse: to wit, so long as they were free from intemperance, the Pulse was altogether equal, and orderly, but if they were more strongly heated than usually, by any sudden passion of the mind, or too great agitation of the Body, presently they were affected with an unequal Pulse, and between the vibrations or strikings, intermitting perhaps 4, 7, 10. or 20. and as often as they fell into a Feaver, the Pulse shewed it self after this irregular manner. When this habitual irregularity, concerning the Pulse, was not yet made known to me, by frequent experience, I was wont to suspect still a malignity in the Disease, and to foretel a fatal event, which hapned otherwise.

On the fifth day, in this sick person, the Feaver, although slowly inkindled, came to an augmentation, and from thence past through the rest of the stations with a swift motion: on the sixth a light emptying of the adust matter, arising to a fulness, a sweat being risen, and so a certain remission of the Feaverish heat followed: on the seventh day, this adust matter arising to its height of increase, made the standing of the Disease, to which, at length on the eighth day, a plentiful sweat, with all things requisite to a good Crisis, followed, and perfectly Cured the Feaver: because (as it ought to be) those three things went before this critical evacuation, *viz.* first a full and sufficient deflagration of the Blood, as appeared by the very strong heat, and plainly fiery, continued for three days before: also secondly, a congection of the adust matter to a plenitude, as was collected by the high disquiet, and tossing about the preceeding night:

and then a certain Pepasmus or Concoction of the same matter, and a begun secretion in the Blood, which a ceasing of the symptoms and signs of Concoction in the Urine, shewed: wherefore, the Copious sweat, coming upon so laudable a sign, so long as there was no suspicion of malignity, portended nothing but good:

About the beginning of the year 1656, a Gentleman endued with an active habit of Body, without any manifest cause, (unless that being much addicted to study, he used no exercise after it) became ill; at first he complained of a nauseousness and want of Appetite, with a great Headach: on the second day, he was affected, now with a shivering, now with heat, several times reciprocating, besides, with thirst, and burning of the Præcordia, with a scurfieness of the Tongue, and an ingrateful savour. On that day, he took ten drams of an Emetick Liquor, by which he Vomited seven times, and cast up a great quantity of yellow bile, and had four Stools; the night following he was unquiet, and almost wholly without sleep, and in which the sick person grew more Feaverish, with an increased heat: on the third day, when the aforesaid symptoms were grown worse, he was let Blood to ten Ounces: his Urine was red, thick, and with a copious sediment; his Pulse quick, and vehement; at night he sweat a little, with a short sleep, but disturbed: on the following morning, he seemed to be a little eased: yet in the evening all things grew worse, with most strong wakings, heat, and thirst: on the fifth day, by a light sweat, the heat somewhat remitted, which yet a little before the evening, returned with its wonted fierceness. The night again was wholly without sleep, with a continual tossing up and down of his Body: In the morning, by a little gentle sweating, he felt a little ease; in the evening an encrease again of all things more cruelly; the night also was very unquiet: about the beginning of the next day, a sweat, as before succeeded, and a little more plentifully: on this day was a manifest change towards health; the heat and thirst was a little less vehement; his Urine was less red, with some Hypostasis; thence, for three days, the Feaver leisurely declined; yet every night he had a certain fit, but more remiss than before, on the eleventh day, he sweated more plentifully, and was perfectly Cured: all the time of his sickness, he used a most spare diet, taking truly nothing of Aliment, besides small Beer, and Posset drink made of it; he sometimes took drink, and cooling Juleps, of boiled Barly, and distilled waters; dayly, if his Belly was not loose of it self, an emollient Clyster was administered: he used no other Physic besides, to wit, neither Purge nor Cordial. But the Feaver being allayed, he was twice Purged, and from thence quickly grew well.

This Feaver was a Putrid Synochus, as may be conjectured by the shivering about the beginning, and then with continual heat, thirst, watchings, and other symptoms grievously infesting, for many days: but forasmuch, as its intemperature was exasperated every night, it might be called a continued Quotidian: This Disease, made its first assault without any evident cause, because the Blood being little ventilated, like Wine growing hot of it self, had conceived an ardour, from the exalted Sulphur; the Choler flowing forth from the Choleduct Vessels, and likewise the Purgings of the raging Blood, being poured about inwardly, (as it is wont to do for the most part in Feavers) presently stirred up troubles, and disorders in the first passages: therefore by reason of the excrementitious matter there heaped up, there was procured a depletion, and soon after the beginning, a Vomiting: notwithstanding which evacuation, and likewise a more strong Purging of the Belly by Stool, if administered, the Feaver being wholly inkindled, because they too much agitate the Blood, and disturb greatly the Concoction of the adust Feaverish matter, for that reason bring more damage for the most part than benefit to the sick: The first station of this Disease, *viz*, until the whole Blood was fired, was extended to the third day; and then from thence, when the Blood flaming forth was burthened with adust recrements, its greater ebullition; with a frequent endeavour of expulsion by sweat followed: on the seventh day, when the Blood for the greatest part had flamed forth, and the adust recrements, heaped up in its bosom to a fulness of swelling up, began to be troublesome, the critical motion was stirred up: by which nevertheless, that matter not being as yet wholly subdued, nor ready for separation, the Disease was not perfectly Cured; but after another period, the same increasing, at last being stirred up, on the eleventh day, brought on that other, and perfectly Curing swelling up: in the days between, because, besides the recrements remaining after the deflagration of the Blood, and reserved for a Crisis, also from the Nutritious Juice not presently taking fire, but after a peculiar manner depraved, other matter in the bosom of the Blood, apt to a swelling up, was gathered together; therefore, from the continual increase, and Flux of this, there hapned to this Feaver continual fits, (such as are wont in Intermitting Feavers) on set days, and hours.

A studious young man, about twenty five years of Age, of a dark Countenance, and Melancholic temper, without any manifest occasion, began to be sick, in the Year 1656. At first he complained of a Feaverish distemper with thirst, a spontaneous weariness, and want of Appetite : moreover, on the second day, of a pain in his right side, and a distention of either Hypochondrium, also, with almost continual Vomiting, wakings, and very great pain of the Head ; a Physician being sent for, he was presently let Blood to twelve Ounces. In the evening he grew more hot, and was light headed, afterwards, a sweat, tho small succeeding, he was better the next morning : on the fourth day again, he cast up whatever he took presently, also he was troubled with an almost continual endeavour of Vomiting. The exhibition of a Vomitory Medicine, proposed by the Physician, both the sick person, and also his Friends, taught by the danger of it before, rejected. From a Clyster given him he had six Stools, and seemed to be a little alleviated ; also the night following he slept somewhat : on the fifth day he again fell into frequent Vomiting, with intolerable thirst : he burnt inwardly, but outwardly could not be felt any immoderate heat ; because the recrements of the effervent Blood, which ought to exhale through the skin, seemed to stagnate within, and to flow forth into the Viscera. Therefore in the evening, this Bolus was given him, to provoke sweat. Of Conserves of Roses Vitriolate one Dram, of *Gascons* powder one Scruple, of *Laudanum* soluted in Balm water one Grain : that night he slept moderately, and by a copious sweat following, the symptoms seemed to be mitigated : Nevertheless on the sixth day, all things again were imbibtered, and a through heat, thirst, and burning of the Præcordia, cruelly tormented him : on the seventh and eighth day the Pulse was unequal, and disordered, for the most part he talked idly, and if moved in his bed, fell often into a swoon. On the ninth day, the same symptoms stopped, also he was troubled with a contraction of the tendons in his wrists, and Convulsive motions of other parts, that we almost despaired of life. Because that morning Nature seemed to be given over as conquered, she was now to be succoured, with what ever remained of Art. Wherefore, intending a more copious sweat, as the last refuge, I gave him a Dram of Spirit of Harts-Horn, at one time, in a small draught of Cordial Julep ; upon which, being for four hours very unquiet and furious, he could scarce be held in his Bed ; but afterwards sleep creeping upon him, he sweat very much, and the business suddenly came to be out of all danger. On the following night, for the continuing of the sweat, I ordered to be given him, every six hours, a dose of the powder of Contrayerva ; the Feaver, and the Distempers of the Nerves, shortly ceased, and the sick person became well.

This Feaver, as to the manner of its figure, may be called a Putrid Synochus ; which, in this sick person, from the Blood being made hot of its own accord, like Hay heating, and so conceiving an immoderate fermentation, took its original : by reason of the Melancholic temper of the Blood, the heat was less strong, altho the symptoms were otherwise worse, and hapned to be chiefly inimical to the Nervous stock : for the Blood burning forth, as fire in a Furnace, covered with chips, glowed with a most intestine burning : therefore, the sick complained of the heat of the Præcordia, with an intolerable thirst, when in the mean time, the exterior parts were but little heated : for this reason, and because the Body was less perspirable, the adust recrements of the Blood being about to make a Crisis, and which were wont to be dispersed outwardly, at set times, being suffused inwardly, (Nature being very much oppressed, and perpetually provoked) brought on cruel, and almost continual Vomitings ; wherefore, when the Feaverish matter was derived to the first passages, by so frequent an endeavour of its expulsion, before the fulness, or concoction, no Crisis followed thereupon. Nor was the sick man the better for that irregular evacuation, yea, the Blood being still made worse in its mixture, began to be corrupted in it self, and wholly to pervert the Nervous Liquor ; from whence, besides the assiduous Vomitings, frequent Swoonings, unequal Pulse, also Deliriums, and Convulsive motions did arise ; but forasmuch, as the mixtion of either humor, and disposition, being not yet wholly loosned, or overturned, the Diaphoretic was administered, which by reason of its great agility, quickly past through both the Blood, and the Nervous Liquor, and a lively, and hasty Fermentation being raised up anew, carried forth of doors their impurities, and extraneous mixtures ; the state of the Disease tending towards Death, was reduced to Health, and by this means, instead of a Natural Crisis, by the help of a supplying Medicine, the sick man, as it were recalled from the dead, quickly recovered Health.

A woman, being about thirty years old, of a strong Body, and Melancholic temper, (as might be gathered by her very austere manners) in the third month after her lying in, got cold in giving her child suck, and uncovering herself, and upon it fell presently into

into a shivering: To this, a heat more increased than usual, followed, which afterwards, (a light sweat arising) quickly remitted. On the second and third day, she was very thirsty, and without Appetite to Food, yet without immoderate heat, that she could scarce believe herself in a Feaver: she lay quiet every night, but wholly without sleep; her Urine was highly red, and with the multitude of Contents, thick, and cloudy, which however not troubled by the cold, remained still after the same manner, without Hypostasis, or sinking down of the parts. On the fourth day, the heat was inkindled throughout the whole, wherefore, a Physician being then first sent for, about twelve Ounces of Blood was taken from her Arm; after the letting of Blood, and her Belly the same day copiously emptied, by a Clyster, in the evening she fell into a sweat, by which nevertheless she was nothing eased, and (tho an Anodine Medicine was given her) she wore out the whole night, (as before) without sleep. On the fifth day, from a Clyster being given, she had three Stools, and felt some ease: her Urine still remained red and troubled: when Blood was prescribed to be taken from her Ham, the sick obstinately refused, esteeming herself to grow well; on the following night, when she had lain long without sleep, and unquiet, she at length was troubled with a fit, such as is commonly called Hysterical, after a grievous manner; and at first, with a certain numbness, or sense of pricking, possessing the extream parts of her Body (especially her Feet, Thighs, and Legs) she was affected; and together with a wind, cruelly distending the Intestines, Ventricle, and Hypochondria: she felt in the bottom of her Belly, as it were a certain bulk to creep upwards; which when it had ascended to the Heart, and thence to the Brain, the sick woman presently was weakned in her Intellectuals, and all the night lay talking extravagantly and idly. On the sixth day, after her Belly was taken down by a Clyster, she returned to her self, and remained in her right mind, and seemed to be indifferently well. But in the Evening when she was moved in her bed, she began to feel the same kind of fit as before, to wit, she had a sense of pricking, as if stung with nettles, in all her body, together as it were a round thing rousing about in her belly, which creeping upwards, distended the Intestines and Ventricle, that she emitted by means of it blasts, and belchings: for ease sake, she required a draught of cold water. Moreover, the Remedies usual in hysterical distempers, as Castor, the smell of *Asafetida*, the fume of burnt feathers, ligatures, and frictions of the Legs, and the like were administered, by the use of which, she seemed for the present, free from the aforesaid distemper, and was wholly without it for four hours: but when she lay upon her back in her bed, as she had settled her self to sleep, on a sudden she complained that the same Symptoms, did at once run through her whole Body; and by and by, she fell upon it into a delirium; howling and crying out, she talked idly the whole night; the day following, her eyes being open, she lay without speech or motion: again in the Evening, when her Feaver being increased, she grew furious, that she could scarce be held in her bed: and so she remained for three days, now delirious crying out, and wailing, now as it were stupid without motion, or voice; yet still she was tormented with Convulsive motions, about the tendons of the muscles: on the tenth day, she drew her breath deep, and difficultly, with a weak, and as it were a creeping pulse, and about the middle of the night died.

This Feaver was of the rank of the Putrid Feavers, which nevertheless, by reason of the melancholic disposition of the Blood, (as we before intimated) was not very grievous, with heat or burning; but yet being very much infectious to the Brain, and nervous stock, was more difficult to be cured: The Blood being predisposed to a growing hot, easily contracted the distemper by taking cold, but yet, from the salt, and earthy feculencies, together with the Sulphur being moved, it was not openly inflamed; nevertheless, burning with an intestine, and as it were shut up fire, it was more notably depraved: Hence, presently from the beginning, the Urine was highly red, and troubled, also she continued wholly without sleep: on the fifth day, the Blood burning forth, and being filled with the recrements, or adult matter, was irritated by its plenitude to an endeavor of excretion; wherefore, this night, a swelling up being arisen, it transferred its load, not dispersable by sweat, into the head, and there affixed it to the Brain, and nervous stock: From thence, presently, the wonted irradiation of the animal Spirits, being disturbed in the fountain it self, their inordinations first hapned to be felt, in the extream parts; wherefore, there was a pricking in the whole Body, the Belly inflated, the hypochondria distended, and as it were a certain substance or live thing, ascending upwards, and successively running through the Belly, precordia, and at length the head: For these kind of Symptoms, arise not (as it is commonly believed) always from vapors, lifted up from the Womb, and striving or thrusting upwards; but, not seldom, from the Brain, and the beginning of the nerves being distempered:

stempered : for, when the evil is there inflicted, that the animal Spirits nigh their origine, are disturbed in their motion, neither (as before) blow up, and distend the nervous Bodies, presently the other Spirits, implanted in the extremities of the nerves, being deprived of their wonted influence, begin to tumultuate, and being moved inordinatly, and towards their beginnings, cause Convulsions in those parts in which they dwell. This irregular, and Convulsive motion, begun in the extremities, by the continued passage of the Spirits, and of the nervous parts, creeps by and by into other parts, and then to others, still to those nearer to the Brain, till at length, (the whole series of Spirits, like Souldiers being carried successively backwards) the Convulsions are continued, into the fountain it self of motion ; So as in truth, by this means, the Convulsive motions, are sometimes begun, a most long way, from the cause, or place of the distemper, as by this only argument plainly appears : to wit, as often as the influx of the animal Spirits, is inhibited in the leg, or arms, by a strict ligature, or by leaning hard on them, a sense of pricking, or a cramp, with a numbness, is felt, first in the foot or hand, which afterwards successively ascends towards the affected part : wherefore, in this sick woman, by reason of the Feaverish matter, (to wit, the adust recrements) fixed on the Brain, by a critical translation from the bosom of the Blood ; and there besetting the beginnings of the nerves, those Symptoms, imitating the hysterical distemper were stirred up : by reason of the nerves, (which are dispersed through the whole Body, by means of the spinal marrow) being distempered near their original, the sense of pricking begun in the extream parts, by and by is perceived in the whole. By reason of a like hurt, of the sixth pare in the fountain, Convulsions and distentions arise, first in its little branches, most thickly set about the Abdomen : That ascent, as it were of a certain substance, was only a tumefaction of the Viscera, and muscles, successively inflated or blown up, by the Convulsion ; from thence, the same distemper (by the mediation or coming between of the branch of the same sixth pare) creeping along more upward, and still more near the Brain, the precordia, and then the head it self, (as by a certain vapor raised up from beneath) seemed to be taken ; on the next day, when this Feaverish matter, at first lightly fixed in the Brain, was at length again amended by the Blood, the aforesaid Symptoms ceased for a time : Then soon after (the Blood again flowing, and deposing its recrements again in the Brain) the same kind of distemper as before, this sick woman felt to come upon her ; which however, with rubbings, the smell of stinking things, and other Remedies used in the hysterical passion, was retarded for four hours, from its assault ; to wit, forasmuch as the animal Spirits, being tyred out by the external object, and irritated into a violent motion, were hindred, that they could not so suddenly conceive Convulsive motions : but afterwards, when that incitation of the Spirits, outwardly exhibited, did cease, the morbid cause still troubling, those Spirits being grievously beset, not successively (as before) beginning at the extremities, but on a sudden, all, both in the Brain, and the nervous appendix, were at once acted into Confusion. The Crisis being after this manner attempted, viz. By the translation of the Feaverish matter to the Brain, the event of the Disease, both in this sick woman, and also in others, whose sicknesses I have diligently observed, for the most part hath a mortal success. For the Blood, unless extremely depraved, and hindred, scarce ever endeavors to purifie it self, by such a Crisis : and as often as it endeavors an excretion by this means, it inflicts on the Brain, and nervous stock, an evil, not quickly, nor easily to be blotted out : also, the mass it self of the Blood, very rarely, by the motion of such a flowing, is rendred free, from the impure mixture of the Feaverish matter.

A learned young man, of a lean habit, and pale countenance, in the coming in of the Spring, being conscious of no error as to his dyet, began to complain of a weariness, and impotency in walking, also of a drowiness, and sleepiness of his head : on the second day also, he was tormented with thirst, want of appetite, and an heat of his precordia : on the third day, the Physician being sent for, he took a Vomit, by which, when he had Vomited three times, and cast downwards five times, cholerick and hot matter, he became somewhat chearfuller, and the night following slept indifferently well : on the fourth day, he bled a small quantity ; then his thirst, and heat very much increased : his Urine was red, with a copious sediment, and a little hypostasis. But because, after the signs of concoction in the Urine, the endeavour of Nature, as it were oppressed, appeared for separation, without sufficient evacuation, therefore he was let Blood to seven ounces, and he seemed thereby to be very much eased, yet in the evening, all things grew worse, and then for three days, the Feaver seemed still to be increased : on the seventh day, he complained of a great heaviness in his head, and of a darkness, turning about in his eyes : after noon, an hemorrhage or bleeding copiously

ously followed, that for the great loss of Blood, the sick person had almost lost all his strength, and there was a very great necessity of medicinal help to stop the Blood: For this end, when a vein in his Arm was opened, Ligatures, and proper medicines were applyed, both to his head and belly, and very many other Remedies (the occasion of hasty curing urging) prescribed by every body, were tryed in vain; at length, by the persuation of a woman, coming there by chance, a red hot Iron was held to his bleeding nose, and on a sudden, from the vapour of the burnt Blood, received into the nostrils, its Flux was stayed; this Remedy, I afterwards knew used to many, with very good success. This great hemorrhage cured the continual Feaver, to which nevertheless, an intermitting quotidian followed, which afterward was quickly cured, by the method of curing already delivered.

This Feaver, beginning without any manifest occasion, and continued for many days with thirst, and heat, may be called a Putrid Synochus; which yet without any horrid Symptom, about the beginning or standing, was cured by an easie course, tho at length by a dangerous, and difficult Crisis: The turgescency of the Blood in the Spring time, and together the defect of ventilation in the same, gave the beginning to this: The Blood burning out, with a Feaverish fire, about the fourth day, had heaped up something of adust matter; that flowing it attempted a critical motion, tho with a small hemorrhage: The defect of a more full evacuation, the opening of the vein supplied for a time, afterwards, the adust recrements being heaped together, in great plenty, the same being not apt to be dissipated by sweat, in a body not rightly perspirable, at the time nature was about to endeavour a Crisis, a mighty bleeding followed: For when the Blood, by reason of the seclusion of the Feaverish matter, is agitated with a critical motion, very many of its particles are loosned from the mixture, so that a greater swelling up being provoked, they carry forth every extraneous thing confused with them: if at this time, the breathing places of the skin, be but little open, the masse of the Blood (as new Wine stopped up in a bottle of a small mouth) even more notably grows turgid, and because it cannot shake off the Feaverish matter, by sweat, it carries itself forth of doors, together with it, any way it can find; wherefore, when there lies a most easie passage, for the boiling Blood, through the vessels opening into apertures of the nostrils, from that Port (like the same new Wine when the vessel is opened) being enlarged by a spumous refraction, it abundantly leaps forth. The continual Feaver being cured, by this means, an intermitting Quotidian followed, because after a long deflagration of the Blood, and great loss of it, what Blood was remaining, being very much deprived of Spirit, and the Salt, with the left Sulphur being thorowly roasted, easily contracted that kind of disposition, whereby it was apt, not rightly to concoct the alible juice, but to pervert it into a matter very fermentative.

A Matron, about sixty years of age, when she had sat up a certain night, going to bed in sheets not thoroughly dry, began to be ill; at first she was troubled with a suffocating Catarrh, that by reason of the serous deluge, falling on the Larynx, she could hardly breath; neither could she sleep; the next day with a nauseousness, and want of Appetite, with some little excess of thirst and heat: on the third day, an acute pain invaded her in her side, with a Cough, and the Feaver increased: her Urine was red, and clear, with a laudable Hypostasis, an unequal, and an intermitting pulse. A Physician being sent for, she was let Blood to ten ounces, also that day, her belly was copiously loosned by a Clyster: About night the pain vanished, and she slept indifferently: her Urine was then red, troubled, and full of contents: on the fourth day, the Feaver was somewhat increased: In the evening troubled with a Cough very much; and by and by following thereupon the acute pain (as before) in the same side; her Urine being again clear, with an hypostasis: Her pain, from her being let Blood again ceased; on the fifth day, the Feaver was more remiss, but at night she was unquiet with heat, and a tossing up and down of her body, but without pain. The next morning she sweated plentifully, and was eased; then using still a slender dyet for some days, and being once purged, she grew well without relapsing. It is worth observation, that whilst the pain troubled her, the Urine was clear, and with an hypostasis, nor troubled by the cold; which however, the same being allayed, became presently thick, more red, and filled with contents.

This Disease, because of the acute pain in the side, as it were a Pathognomic signe, might be called a Plurisie: but we have here a Feaver, preceeding the pain, and not the product of it; The evident cause of the sickness was Transpiration being hindered by the constriction of the pores; The Blood growing hot, by reason of the *Effluvia* being retained, and also too much abounding with a serous latex, as it were vomiting very much of it, from the Arteries terminating in the Larynx, caused the sense of the suffocating

suffocating Catarrh: For this kind of distemper (as also the Cough with great spitting) arises not, for that the watery humor (as is commonly said) falls from the head, into the throat, and lungs; but because the serous Latex is poured forth, now from the pneumonic vessels, immediately into the lungs, now dropping forth from the Arteries opening into the larynx, falls down on the breast; on the third day, from the same serous humor, with a portion of the Blood, being fixed in the side, the acute pain arose; for the Blood beginning to grow fervent, when as yet it did contain in it self a crude matter, and (as it should seem) something sour, from the degenerate alible juice, deposited the same, (because it could not cast it forth of doors by sweat) by a proper illustration or purging through the intercostal Arteries, into the membrane surrounding the Ribs; and there (as it is always wont in a Plurisie) either by coagulation, (which may be lawfully suspected) or by the shutting up of the vessels, the Blood being intangled with the same matter, is stopped in its motion; then being increased in its bulk, by a new coming still of the Blood, it causes a break of the union, and so an acute pain. That in this sick woman, the same kind of matter, disturbing the mass of Blood, with a portion of it extravasated, was fixed about the Pleura, it from thence hapned, because the pain urging, the urine was clear, and not full of contents: then, when the vessels, by reason of Phlebotomie, being emptied, they supped up again that matter, into its mass, before exterminated from the Blood, the urine presently became troubled, and again big with contents: The pulse was unequal, and intermitting, because of the idiocrasie or proper disposition, which she was wont to have in every intemperature: for when I cured this woman of a Feaver, many years before, her pulse being unequal, and intermitting, had struck a fear in me, and others, of a sad presage, concerning the event of the disease, which however at that time, (as also in this sickness) ceased, prosperously, without any horrid Symptom.

A strong young man, and corpulent, after immoderate exercise, about the Summer solstice, and then a sudden cold coming upon the heat, found himself ill: At first, a want of Appetite, nauseaousness, and cruel pain of the head, as also thirst, and a more intense heat than usual troubled him; on the second day, an acute pain invaded him in his right side with a Cough, and difficult breathing; Blood being presently taken plentifully from the Arm of the same side, that pain remitted somewhat, which yet in the evening returned, being made more cruel by a Cough, and bloody spittle. The night followed, without sleep, and very unquiet: on the third day, he was again let blood, besides Liniments, and fomentations were applyed to his side; Moreover powders, Juleps, and antipleuretick decoctions, being taken inwardly, about night the pain almost wholly ceased. Then by and by, he was afflicted with a cruel headache, and a vertigo: on the fourth day, a stream of Blood fell from his right nostril, about two ounces, by which the pain of his head clearly ceased, and the vertigo; but in the Evening, the pain in the side before distempered, returned with greater fierceness: In the mean time his Pulse was small, and weak, that when it was consulted upon, for the letting him blood again, 'twas thought dangerous, lest his dejected strength would not admit of such a remedy: wherefore, Phlebotomie was performed only, in a very small quantity, and a fomentation, and a Cataplasme was prescribed to be diligently applyed to his side; besides twenty drops of the spirit of Harts-horn, to be taken in a spoonful of Cordial Julep, and the same to be repeated continually, within the space of six hours: He sweat that night very much, and the pain much remitted, his spitting was but little, interspersed with Blood, which, within a day wholly ceased, and the pain also leisurely vanished. The sick man took twice a day, a scruple of the same spirit of Harts-horn, and within a few days, he grew perfectly well, without relapsing.

This Feaver was a simple Synochus, stir'd up from the evident cause, viz. a Constriction of the pores: as soon as the Blood began to be somewhat filled with adult recrement, and so to swell up more, the matter, which should have been separated, by reason of its peculiar evil, was transferred into the Pleura, and being there fixed, compelled the Blood coming to it, to be coagulated, and therefore to be stopped in its circulation, and (when it could not be received by the veins) presently to be extravasated: from hence hapned the acute pain in the side, and bloody spittle, by and by, after the beginning of this Disease; then afterwards, the same matter being thrust out of that nest, which it had got, and being supped up again into the mass of Blood, was fixed in the head; and there inducing the like stagnation of the Blood, and (as it is probable) coagulation, caused the vertigo, and cruel pain; which nevertheless was quickly cured, by the hemorrhage being arisen, by reason of the extravasated Blood. A part of the morbid matter, being after this manner drawn away, the other part returned

refumed by the Blood, was again conveyed to its usual nest, to wit, the side before distempered; where depositing its latex, (to wit, a portion of the Blood) it did coagulate it again, and compelled it to be extravasated or to flow out of the vessels: For that pain being renewed on the fourth day, with the bloody spittle, from the ebullition of the Blood, too extreemly, and therefore flowing out of the vessels, would not be brought away; because at that time, the Pulse was small and weak, with a falling down of the vessels, that indeed the Blood was thought to have been run all out of the vessels, for that being coagulated by the morbid matter, (and therefore tho expelled the Arteries, yet not being able to be carried back by the veins) it was stopped in its circulation. Upon this, an acute pain followed, because the Blood being heaped together by its frequent approach, and elevated into a Tumor, made a dissolution of the union; also, by and by from the beginning, a bloody spittle came upon it, because the Blood being restrained within, in the Body, somewhere in its motion, by reason of the most tender, and easily opening little mouths of the vessels, ran forth into the Cavities; when to the same outwardly extravasated, by reason of a more thick skin, and the mouths of the little vessels being locked up, no way lay open, unless by its being made and ripened into an Imposthume. The opening of a vein profited in the beginning of the Pleurisie, because it restrained the Blood, somewhere hindered in its circuit, from too great effervency; but especially, for that, when the vessels were by that means greatly emptied, they did again receive, and render fluent, whatsoever humors were before exterminated, and also the Blood beginning to stagnate in the distempered part. Also, the remedies helping most, about the beginning of this Disease, were of that sort, which hinder the coagulation of the Blood, or dissolve it in the coagulating; such they are, which abound very much with a volatile, or an alkalifate Salt: to wit, spirit of Soot, of Blood, Harts-horn, also spirit and salt of Urine, the powder of the claws and eyes of Crabs, of a Boars tooth, or the Jaw of a Pike, are of known use. Among the common people, it is a custom to drink an infusion of Horse dung; which medicine indeed, I have known often to have brought help, in deplorable cases. In the mean time, all acid things whatsoever, because they more coagulate the Blood, and hinder expectoration, are highly hurtful in this Disease.

C H A P. XII.

Of a malignant or pestilential Feaver in general.

BESIDES the continual Feaver, which is already described, and which arises from some principle of the Blood being too much carried forth, there is another species of this, which is stirred up, by reason of the Blood being touched with some invenomed Infection, and therefore liable to enter into various coagulations, and corruptions: In which, not only the Spirit and the Sulphur, as in a Putrid Feaver, rage, and compel the Blood to grow immoderately hot, but besides, the mixture of the Blood is presently dissolved, and its liquor goes into parts; and so most horrid Symptoms, with manifest danger of life, are induced in this sort of distemper. Under this rank, we comprehend malignant, and pestilential Feavers, the Plague, small-Pox, and Measles: of which we shall speak presently.

Pestilential Diseases, wander so in the dark, and have an unknown original, that their causes, and beings are seldom explicated, without having a recourse to occult qualities. By the unanimous consent of all, the strength, and power of these are placed in an invenomed matter; because we perceive, from a pestilent distemper, strength suddenly to be overthrown, and life quickly destroyed, no otherwise than from the drinking of Poyson. And therefore, for the explicating the nature of the pestilence, it will not be besides the matter, first, to inquire concerning Poyson in general, and by what means it distempers our Bodies, then to shew what sort of Poyson is sprinkled in the Plague, and contagious Diseases: which being performed, we will treat particularly of the Diseases but now recited.

Every thing deserves the name of Poyson, which striking into our Body, after an occult manner vehemently hurts the temper, and actions of any part, or of the whole, profligates the Spirits, or perverts their motions, solves the mixtures of the Liquors,

and

and induces Coagulations and Corruptions, destroys the functions and ferments of the Viscera, and so suddenly and hiddenly brings life into danger. of these, which after this manner lie in wait for us, there is a mighty plenty, and very rich provision in the nature of things: oftentimes they are inly begotten within our body; outwardly they are abundantly supplied from every Coast, and out of every tract of Earth, water and air, these daily arise out of the distinct families of minerals, vegetables, and Animals, and so mingle themselves with our food, yea with our medicine, that we may complain with Plinie, *quod non sit fateri, an rerum natura largius mala, an remedia genuerit*. That it was not known, whether Nature had begot greater Evils, or Remedies.

As there is great varieties of Poysons, so, as to their Subjects, and ways of hurting, there is no less diversity of them: for the most Poysons, in their whole substance are said to be contrary to us, that whatsoever they come to, with a burning force, and like fierce fire, they reduce into ashes, yet out of these, some being noted for a peculiar raising of hurt, do more endamage one part or substance than another. The subjects, on which the taint of Poyson, is next and more immediatly inflicted, are twofold; to wit, the animal Spirits, or the spirituous subtil Liquor flowing in the Brain, and nervous stock; and the Blood flowing in the Vessels, and heart, when the object is carried only to one, or being impropportionate, at one to either, that from thence, the disposition of the Liquors, or of the containing parts, is overthrown, whereby the necessary functions, for the performing of life and sense, are restrained, and this done latently, and as it were unforeseen, these kind of distempers, we ascribe to Poyson.

The nervous bodies, with the animal Spirit, are not invaded wholly after the same manner, by every sort of Poysons; for they are tormented, now with a Stupor, now with Convulsions, and those of divers kinds, and manners: The bile of a Tarantula causes dancing: A power sent from the Torpedo, by the Angle, or lines of the Net, stupifies the hand of the Fisher. The roots of the wild Partnip, or the seeds of Lolium or Darnel, being eaten, make men mad: Opium, Mandrakes, Henbane, and the like, cause deep, and sometimes deadly sleep. These and many others, chiefly impress their Poyson, on the spirituous or animal faculty, without any great perturbation of the Blood, or hurt brought to the heart.

There are also some Poysons, which most of all insinuate their malignity, to the mass of Blood; wherefore, from some Medicines, there have been produced, a yellow or black Jaundice, sometimes a Leprosie, or leprous distempers, and swellings of the whole body, vapours breaking forth from secret hollows of the Earth, also from Coals newly inkindled, often suffocating the vital Spirits, at once congeal the Blood, and stop it in its motion, whereby the flame of life in the heart, could not be continued. How much corruption of the mass of Blood is imparted from the pestilent Infection, is perspicuous to every one, from the spots and Whelks, which are as it were the marks of the blasted Blood.

If the hurt, being first inflicted to either, *viz.* The regiment of the Heart, or Brain; be more lightly made, it is for the most part cured, without any great offence to either; wherefore, Convulsive motions, Stupifaction, Lethargie, Melancholy, Paralytick distempers, do not seldom begin with a laudable Pulse, and without an immoderate effervescency of the Blood; and then, if the distemper does not get strength, leisurely end, and cease. There are other Poysons, which often deprave the Blood, and by dissolving its mixture, corrupt it, in the mean time the animal functions remain whole enough. But if the ferment of the Poyson be stronger, and hath more deeply fixed its roots, presently the Poyson is dispersed, from one Province to the other: for when the nervous parts swell up, with a virulent juice, a portion of the Poyson, is carried with the nervous Latex returning through the Lymphatick Vessels, into the veins, easily into the bosom of the Blood, and infects its mass, with the evil with which it was big: also, from the Blood being grievously impoysoned, the juice, by which the nerves are watered, quickly contract the infection; hence mad men are in a Fever, and those taken with a pestilent Fever, are most often tormented with a Delirium, or Phrensie. Concerning these things, we must consider, what the alteration is, or the impression of hurt, which is inflicted from the Poyson, to the animal Spirit, with the brain and nervous appendix; and what also, to the Blood, with the Heart and the annexed Vessels: tho here, it is not in the power of humane skill or wit, plainly to shew, or as it were point out with the finger the manner of its being done; yet we may be able to attain to some little knowledge of this thing, by reasoning, and by comparing it, with other distempers.

Concerning the former, we shall observe, that the subtil Liquor, or animal Spirits, where-

wherewith the Nervous Bodies are blown up, and by whose expansion, sense and motion perform their reciprocal actions, are easily perverted from their tensility, and equal expansion: for as the Nerves are of a soft texture, and the Spirits which abound in them of a very subtil substance, they cannot endure any strong or vehement objects; wherefore when any violent or improporionate thing falls on them, they are often compelled from their expansion, and excursion into flight, and a running backward, and not seldom into irregularities of motions: wherefore sudden passions of the mind distract them, and drive them into Spasms, and Convulsions; when the Alible Juice, by which they are repaired, is supplied too sharp, sour or austere, they suffer now Palsies, and now contractures: If that some object more incongruous, (such as we have affirmed Poyson to be) should be offered, whose Particles are indued with such fierceness, or are of such a kind of configuration, that when they grow impetuously hot with the Nervous Liquor, they shake or lose here and there its more subtil or spirituous part, or wholly drive it away, and fix the remaining Liquor either with a styptic force, or by ebullition, force it into inordinate motions; hence of necessity, evil distempers of the Brain, and Nervous parts arise, *viz.* sometimes a Convulsion, Trembling, Shivering, sometimes loosings, or a stupification, and other symptoms of more grievous note. What things after this manner infect the Nervous Juice with Poyson, are now more thick, and only when they are applyed in a very Corporeal substance, do inflict their hurt; now they are thin, and being resolved, even into a vapour or breath, pour forth from a certain little prick, the ferment of Poyson, through the whole Nervous stock. Sometimes the Poyson of some hurtful thing, being eaten, first begins its Tragedy in the Ventricle; more often by a naked touch, leaves on the superficies of the Body, a virulent taint, which easily and quickly with its ferment, Contaminates the Spirits, dispersed through the whole. The Infection, wherever inflicted, either within or without, is more largely dispersed from the extremities of the Nerves, by their easie passage, being from thence brought into consent of the evil, by the very many little shoots of the same branch. Often a more light touch of an invenomed thing, by the finger, or extremity of any other member, presently communicates to the Brain, the received infection, and from thence it is retorted into the whole Body, and the farthest members; the reason of this is, that both the Particles of the Nervous Juice, and of the same invenomed infection, are so light, and ready for motion, that they pass through most swiftly, as the Rays of light through a Diaphanous medium, the whole mass of one another.

2. As often as the Blood, contracts hurt from some Poysonous thing, the Poyson is fixed within; either slow, and of lesser activity, which does not presently betray it self, nor break forth into cruel symptoms, till of a long time after, it is ripened by a silent fermentation, and hath first infected the whole mass of Blood, as may be observed in some Poysons, which are said to kill at a distance, and not till after some months, or years. Or the Poysons inspired into the Blood, are imbued with a much more acute sting, that from their Contagion, the Infection contracted, presently breaks forth into cruel symptoms, and thereupon follows now a Feaverish effervency with Vomiting, Thirst, and burning of the Precordia, now a swelling up of the whole Body, a discoloration of the skin, oftentimes a breaking forth of wheals, and buboes, and frequently also a sudden loss of all strength, so that sudden death, without tumult, and almost insensibly steals upon one: where by the way it is to be noted, If the Spirits of the Blood, provoked by the enemy, are able to encounter him, and to strive for the victory, this Feaverish ebullition of the Blood is stirred up from the conflict; but if the Particles of the Poyson, being far stronger, suddenly profligate the Spirits of the Blood, and extinguish life, presently the Bloody mass is corrupted, neither can it be circulated in the Vessels, nor rightly inkindled in the heart.

If it be yet demanded, what mutations, the Blood infected with Poyson, undergoes, either in its substance, or consistency, that, for that reason it is rendered unfit for the sustaining of Life? I answer after this manner; some Poysons fuse the Blood, and too much precipitate its serosity, such are Medicines, which by a strong killing Purging, or by a *Profluvium* of Urine, or a discoloration, or swelling up of the whole Body, or with an eruption of Pustules, cause a very great secretion of the serous Latex; in the mean time a great ebullition of the mass of Blood is induced, whereby the Vital Spirits are greatly destroyed, the Particles of Salt and Sulphur too much exalted, by the Concoction, and are often so roasted, that a Yellow or Black Jaundies is caused.

There are Poysons of another kind, far more dangerous, which congeal the Blood, and by destroying its mixture, corrupt it, *viz.* the first induce a congelation to the Bloody mass, and then a Putrefaction: for when the Spirits of the Blood, being over-

thrown, by the contagion of the Poyson, are dissipated, the equal mixture of the Liquor is loosned; wherefore the more thick Particles mutually infold one another, and (like Milk when Rennet is put to it, or growing sower of it self) are coagulated apart: hence the Blood curdles in the Vessels, that it is less readily circulated in them: coagulated portions of this, being inwardly diluted, into the bosom of the Heart, are apt to stagnate there, and so to bring forth frequent syncope, and swoonings: being carried outwardly, and in the circulating, fixed in the skin, sometimes being more plentifully heaped together, they induce a suffusion of blackness through the whole, sometimes being more sparingly dispersed, they cause only spots, or Purple marks, like black and blew stroaks, and other appearances of malignity. But the coagulation of the Blood, quickly disposes it to putrefaction or corruption; as is seen in extravasated Blood, which is wont to grow soon black and putrid. For the Spirit being exhaled, the Particles of Sulphur and Salt remaining in the Blood, begin to go apart one from another, and to break the bond of the mixture, from whence follows Putrefaction.

These things being thus premised of Poyson in general, the reason of the method requires that we enter upon the handling of Feavers, which draw their Original, altogether from a malignant, and invenomed infection: and as under this title, the Pest or Plague easily obtains the chief place, I will begin with its consideration, and afterwards, I will speak of malignant Feavers, Small-pox, and Measels, in order. But yet, before I shall propose its definition, I will briefly inquire, of the pestiferous Poyson, what its disposition and Nature may be; also, from whence it may be born, and lastly, by what means it is propagated into others, by contagion.

For the expressing the Nature of the Plague, Authors are wont to choose some invenomed Bodies, and from their names to frame an Elogy of this most wicked Disease; wherefore in the definition of the pest, are commonly recounted the Nepelline, Aconital, and Arsenical Poyson: the Lethiferous force of which however, as it consists in a very thick matter, and does not exert or put forth itself but by a Corporal contact, doth not truly imitate the essence of the Pestilential Disease: for this is founded in a Spiritual and Vaporous infection, by which its *Effluvia* being every way diffused, so potently unfold themselves, that out of the best seminary or seed plot, they quickly propagate a fruitful Crop of death and destruction. By reason of its notable activity, this infection may deserve to be called, as it were a certain quintessence of Poyson; the very agill and subtil Particles of this, do penetrate all Bodies, and inspire them with its ferment: for either being dispersed through the Air, or hid in a certain tender or cherishing nest, tho they strike against the human Body but lightly, and as it were through a Casement, they easily subdue it; for both the Animal Spirits, and those of the blood, they quickly infect, and by that means, shortly pour forth the Venomous taint, into all the members.

When a Pestilential Breath or Vapour, hath invaded any one, and that Poyson hath first laid hold on the Animal Spirits, or those of the Blood, or both of them at once, (as hath been already said of Poysons) the taint is quickly derived from the subtil and more thin substance of these, into a more thick matter: because it quickly ferments the whole mass of Blood, or of the Nervous Juice, and the excrementitious humors, every where abounding, and from thence is deduced into the solid parts, and fixes the evil in them. If this Disease, first possesses the Animal Spirits, presently the hurt is communicated to the Brain, and the Nervous stock, and especially to the Ventricle, forthwith it impoysons the humour growing in these; loosens its mixture, perverts the regular motion, and render it wholly incongruous, and infestous to the more tender substance of the containing parts: by and by from thence, Cramps and Convulsive motions, cruel Vomitings, pains of the Heart, also Phrensies, deliriums, or pertinacious watchings, are stirred up, about the first assault of the Disease: when in the mean time, the infection not being yet dispersed through the Blood, the sick are not Feaverish, nor are troubled with inordinate Pulse, or Syncope, or appearances of marks; which symptoms however arise afterwards, as soon as the Blood is infected. If when the Spirits of the Blood are first possessed, with the impoysoned infection, either drawn in with the Air, or attracted through the pores, its ferment is presently dissipated through the whole mass of the Blood, the infested portions immediately begin to be loosned from their equal mixture, to go into parts, and to be coagulated, and the same, being delated, into the bosom of the Heart, are wont there to stagnate, and so to induce a Syncope, Swoonings, and often sudden Death; also being carried outwardly, fixed about the skin, to cause Buboës, inflamed risings, and other marks of Poyson; in the mean time, the sick appear well in mind, nor are they troubled with Delirium

nor Convulsive motions. If that from a more strong cause, the hurt is inflicted to both parts at once, the course of the Disease is performed with a more horrid provision of symptoms, and especially with a Syncopy, and Phrensie at once infesting.

As to what appertains to its rise; when the Plague first arises in any Region or Country, there is attributed a twofold cause of it, *viz.* Primary or Metaphysical, also Secondary or Natural, subordinate to that: The very Heathens did acknowledg this Disease, wherever it raged, sent first of all from God, for the castigation of the wickednesses of men, and therefore for its extirpation, they equally made use of Prayers and Sacrifices as of Medicines. As to what belongs to the Natural cause, there are divers opinions. Some will, that the Pestilence newly arisen, be derived from the Heavens, and influences of the Stars only: on the contrary, others have affirmed it only to arise from the internal putrefaction of the humors of our Body: but these endeavour to deduce the cause of this sickness too far off, and these more near than it ought. We will walk in the middle way, and what Reason persuades, and what very many Authors assert, we will place the chief and first seminary or seed plot of this Poyson, in the Air; because, it seems consonant to Reason, that from the same Fountain, from which the common food of life is had, the beginnings of death, no less diffusive, are to be sought. There is the same necessity for our breathing in the Air; as of Fishes living in the Water; wherefore, as to waters infected by Poyson, the murrain of Fishes dying in heaps is ascribed; so men dying of an Epidemical slaughter, without any manifest cause, nothing could kill, besides the infection of the commonly inspired Air.

For the Air, which we necessarily draw in for the continuance of Life, consists of an heap of vapors and fumes, which are perpetually breathed forth from the Earth; in which the exhalations of Salt and Sulphur, being mingled with the atomical vaporous little Bodies, constitute here as it were a thick cloud: the motions of these are swift and unquiet, they are of a manifold figure, and very much diverse, wherefore some continually meet against others, and according to their various configurations, they cohere with these, and are mutually combined one with another, and from those they are driven, and fly away: from hence the reasons of the Sympathy and Antipathy of every thing, depend. From the diverse agitations of these kind of Atoms, near the superficies of the Earth, this or that tract of the Air, enters into diverse alterations, by which, Bodies, chiefly the living are variously affected: because the intestine motion, of the Particles of every Animal, depends very much upon the motion and temper of the Particles of the Air: forasmuch as these perpetually exagitate those, raise up those lying asleep, repair the loss of those flying away, shake the vital flame with their Nitrosity, and supply it with a Nitrous-Sulphureous Food, eventilate it being inkindled by continual turns of access and recess, and carry away the Soot and Fumes. So long as an apt contemperation happens in either, for motion and configuration, living Creatures enjoy perfect health and life; but if the little Bodies swimming in the Air, be of that sort of figure and power, that are plainly adverse to the Spirits implanted in living Creatures, they loose the mixtures of these, from the rest, from whose Elements they are collected, and pervert their motions; hence the dispositions of things are destroyed, life profligated, and, the same being scarce extinct, the Bodies undergoe putrefaction; hence the tops of Trees, or of Corn, being struck with a blast, suddenly grow dry or wither; hence among Cattel, the murrain often rages, which kills at once whole Flocks; by reason of this kind of cause, the Seeds of the Pestilence first put themselves forth, and attempt the slaughter of human kind: for as invenomed Bodies in the bowels of the Earth or concreted on its superficies, produce the Arsenical or Aconital mixtures, so these being even resolved into vapour, and heaped together in the Air, create most pernicious Airs, from which Malignant and Pestilential Diseases arise; the infection, which after this manner Contaminates the Air, the most ingenious *Diemerbrochius*, a searcher of this Disease, contends, that is only sent (as the wrath of angry *Apollo*) immediately from the angry right hand of God: but this were to multiply without any pretext of necessity (I will not say beings but) miracles, and in every Plague to assert a Creation of new substance; when in the meantime, the virulent product of Minerals and Vegetable, which daily appear, and of as quite adverse Nature to us, as the Plague, clearly testify, that there lives hid in the Bowels of the Earth, plenty of invenomed matter, sufficiently fitted for this business. For the little Bodys, which being roled about with earthy matter, do constitute the Poysonous mixtures in the bosom of the Earth, the same being resolved into vapours, will be no less hurtful afterwards, and impress a pestiferous blast to the Air, which they wander through: wherefore, by the leave

of so Learned a man, I should say, that it seems not improbable, that the things which first of all affix the seed plot of the Pestilence, to any tract of Air, be the Poysonous *Effluvia* of fierce Salts and Sulphurs, and (by the Divine Will instigating) breathing forth from the bowels of the Earth; which sometimes, being a long time before shut up, are leisurely exhaled out of Dens and Caverns; sometimes by reason of the motion of the Earth, or Earthquake, or a gaping of the Earth, they break forth in heaps; also, of the same kind, are those which ordinarily are breathed forth from the filth of Souldiers in their nasty Camps; or from unburied Carcasses; or from places, beset with standing and stinking Mud: but the little Bodies after this manner exhaled, obtain their wonderful height, properties, and abilities, by a long putrefaction, that therefore they are incongruous, and heterogeneous to all others whatsoever, and so being received into the Air, ferment it (as it were a mass of Liquor) and pervert it from a wholsom and benign, into a most pernicious and wicked Nature.

Some Bodies more easily, others not so readily receive the malignant tincture of the Pestilential Air. Those who by reason of ill feeding are full of evil humors, and who by reason of fulness, have their Blood stuffed with firable Sulphur, receive the Pestilential Poyson, by the least blast of the invenomed Air, especially if fear or sadness happen, which convey inwardly, and lead to the Heart, as it were by a certain attraction the most light darts of the contagion. On the contrary, those who have their Viscera clean, and the mass of Blood well tempered, and are indued with a strong, and fearless mind, do not so easily receive this infection, and sometimes exterminate it soon, being received.

Thus much for the beginning and divulgation of the Pestilence, according to its first Fountains, and from thence the stream of the infected Air being deduced: it remains for us to speak concerning its propagation by contagion, forasmuch as it is derived, as it were extraduce from some and so to others.

We understand by Contagion, that force or action, by which any distemper residing in one Body, excites its like in another. But as this may happen, either immediately by contact, as when any one lying in the same bed with another, taken with the Plague, or mediately, and at a distance, as when it happens that the infection is transferred from one house to others remote, or also if the Plague come upon any one, after many days or months, perhaps years handling a Garment, or house-hold stuff, brought from an infected house: therefore that the Nature of the Contagion, and its diverse modes may be plainly made known, we will first weigh what that is, which streams from an infected Body. Secondly, how it bears it self through the Medium of its passage. Thirdly, by what means it begets a distemper like it self, in another Body.

1. That from every Body, altho of a more fixt Nature, *Effluvia* of Atoms constantly fly away, and run forth, which round about constitute as it were a Cloud or Halos, and as it were cloath it, like the down of a Peach, is so much received among the more sound Philosophers, that nothing can be more. But by how much the more any thing consists of active Particles, by so much the more, it sends from it self, little Bodies of more remarkable virtue and energy. Hence the *Effluvia* which fall from Ambers, are able to move other Bodies from their place: emanations proceed from Sulphureous things, which fill the whole neighbourhood with odors. And so when the Pestilential venom, as hath been already said, is from hence any where fixed, and tho in the smallest bulk, is of great efficacy and operation, there is a necessity, that some emanations, proceed from the Bodies imbued with it, which refer the nature or disposition of the same Poyson and malignity, and diffuse them on every side according to its spear of activity. But when these little Bodies, which retain the contagion of the Pestilence, as they stream from one Body, are not presently received by another, we shall inquire, how they carry themselves, in respect of their passage, through the medium.

Where we shall presently meet with a difference in those, from many others, for that the *Effluvia*, which ordinarily evaporate, do not long retain the Nature or Disposition of the Body, from which they flow, but either vanish into Air, or being impacted to other Bodies, are assimilated to them: but those Particles, which fall from a Pestilential Infection, are not easily supped up by the Air, or any other Body, so as they may be wholly destroyed; but among the various confusions of Atoms, and the dashings of other Bodies, they keep themselves untouched. For this untamed Poyson remains still the same almost, and not to be overcome by others, and tho it consists of never so little heap of Atoms, will not presently vanish; but with its ferment, imbues the next little Bodies, and so acquires new forces, and gains strength by going; from whence it lurks a long while in some nest, and after a long time, when it assaults

a convenient subject, puts forth it self, and imparting the taint of its Poyson to another, raises up again the Disease of the Pestilence anew, which seemed before to be exploded, and tho from the smallest seminary, sprinkles far and near its deadly Poyson.

For the Pest, brings forth such most sure signs of its contagion, that some Authors contend, that for this reason it only continues among Mortals, and doth never spring up anew, but is only conserved from its nest, and carried from thence, from one Region to another. Histories relate, that the seeds of this have lain asleep for several years, in some Garment or Bedcloaths, and that afterwards, they being stirred, it hath appeared, and hath stirred up anew the Disease of the Pestilence, increasing with a mighty slaughter of men. When by reason of the tinder, or cherishing nest, the Plague is propagated after this manner, at a distance, the invenomed little Bodies, which remain in the infection, being moved, presently leap out, and unfold its Poyson every way, as it were by a certain irradiation: if that they strike against an human body, presently they lay hold on the Spirits, and are by their Vehicle conveyed inwardly, and then by an easie labour, they infect the Blood and Humors, wheresoever flowing in the Vessels, with their ferment, and quickly bring to them coagulations and putrefaction. And after this manner, through the most subtil *Effluvia*, is made as it were a certain transmigration of the Pestilential Disease, even as when a shoot being cut off from some Tree, and laid up for a time, and afterwards ingrafted to another Trunk, tho from the smallest bud, it is able to produce a Tree of the same Kind and Nature.

C H A P. XIII.

Of the Plague.

THUS far we have discoursed of Poyson in general, also of the Pestilence, its beginning and propagation by contagion: it now remains, that we explicate the description of the Plague, its Nature, according to its accidents, and symptoms, most worthy of note; then some things shall be added, which belong to its Cure.

The Plague may be described after this manner, that it is an Epidemical Disease, Contagious, highly infestous to human kind; taking its beginning from an invenomed Infection, received first by the Air, and then propagated by Contagion; which having hiddenly and largely set upon men, causes extinctions of the Spirits, coagulations of the Blood, blastings, mortifications or deadnesses of the solid parts, and with the appearances of whealks, buboes, or carbuncles, as also with the horrid provision of other symptoms, brings the sick in danger of life.

Altho the Plague be one kind of Disease, and its specific differences, or essential are not found, yet by reason of the divers kinds of accidents, which come upon it, some diversities and irregularities of it are observed, which something vary the type of the Disease, tho they change not the species. For first this distemper sometimes is more universal that it rages every where through many Vilages and Cities at once; but sometimes it is circumscribed in narrower bounds, and only threatens one Region or Tract of Land. Secondly, sometimes the Plague comes simple, and unmixt with other Diseases, wherefore privily, and as it were by surprise, almost without a Fever, or vehemency of symptoms, brings a secret killing of the sick. Sometimes it is complicated, with a number of other Diseases, that the business is carried with tumult and frequent skirmishing between Nature and Death. Thirdly, the degree of malignity constitutes a great difference; for the Plague in some places, and times is much more mild, that many of the sick escape; sometimes it is highly mortal, that most taken are killed, and that scarce one of an hundred recovers.

But because this Disease hides its weapons, and coming on men unawares, kills them suddenly, therefore it shall be our work, that by some signs, as it were watchmen planted, we may know the Clandestine coming of this enemy, altho we are not able to foresee it from afar. Very many signs happen, which foretel shortly a Plague about to come: to wit, if the year keeps not its Temper, but has immoderate, and very unseasonable excesses, either of heat or cold, or of dryness or wet; if the

small

small-pox or Measles, do every where rage ; if Boils or Buboes, accompany reigning Feavers. Besides Astrologers are wont, from the Aspects of the Stars, or appearances of Comets, to predict the approaching Plague, but this ought rather to be called a vain conjecture, than a certain foreknowledge. From a preceeding Famine, a most certain presage may be taken, of a Plague to follow, as in the Adage-*Μετὰ λιμὸν λαμὸς*. The Plague comes with the Famine. For the like Constitution of the year, which for the most part, by reason of the Corn being blasted, brings scarcity, is apt also to produce the Plague : also, an evil way of feeding which people in dearths use, eating all unwholsom things, without choice, disposes their Bodies, to the more easie receiving the Infection. Yea, also earth-quakes fresh openings of Caverns, and secret Vaults, by the gaping of the Ground, by reason of the eruptions of malignant and impoysoned Airs, often give beginning to the Pestilence. For indeed, as there is need of great diligence, to foresee, as it were from a watch-Tower, the approaching Plague, so there is no less need of care and diligence, to consider, or take notice of the same, being fresh risen, and the shooting of its first darts : For oftentimes, being too solicitous, we dread vulgar Feavers, if perchance they end in death, for this Disease ; and sometimes being too secure, contemning the Pestilence, by reason of its Symptoms, like to a common Feaver, we apprehend not our danger, till too late ; wherefore, for the more full knowledge of this Disease, we will subjoyn its Signs and Symptoms, both common, and Pathognomic or peculiar, and briefly describe their causes, means, and manner of being done.

Besides the signs already delivered, which by a certain demonstration *à priori* or before-hand, bring a suspicion of the Plague about to come, there are others, the concurrence of which, plainly shew its presence, in the sick body : of these, some are common to the Plague, with a Putrid Feaver, some are more proper to this distemper. For the impression of the Pestilence, most often stirs up an effervency of the Blood, and so has frequently a Feaver joyned with it, that among some, in the definition of the Plague, it hath the place of a kind of Feaver ; wherefore, by reason of the ebullition of the Blood, and the hurt brought to the Viscera, presently there follows, a growing hot, a spontaneous weariness, thirst, a burning of the precordia, often great Vomiting, pains of the Heart, torments of the Intestines, a scurfiness of the Tongue, or a blackness, a pain of the head, watchings, Phrensie, palpitation of the Heart, swooning, and sudden loss of strength : tho Feavers are most often beset, with these kind of Symptoms, yet if at the same time, the Plague hath spread in the neighbourhood, and a fear of it hath possessed the minds of men, hence a greater suspicion of this evil is caused, especially, because, whilst the Pestilence reigns, other Diseases in any one, leave their proper Nature, and change into it : wherefore, if there happens to the distempers but now recited, a Communication of the same sickness to many, and a frequency of Burials, that it becomes every where very deadly, and spreads largely even by contagion ; and if besides, Buboes, Carbuncles, Spots, or other marks of the pestiferous infection appear, the business is put without doubt, and we may with no less faith denounce it the Pestilence, than when we see an house flaming, with fire breaking through the Raftures, we cry out Fire. But because here is mention made of Buboes, Carbuncles, and of other Symptoms, (of which we have already spoken, where we treated of Putrid Feavers) it remains, that we briefly touch the causes of them, and the manner of their being made : They are these : A Carbuncle, a Bubo, Wheelks, Inflammations, and malignant Pustles.

Concerning these in common, we say, that they are all produced of the Blood, and nervous juice, touched with the pestiferous Poyson, and coagulated in parts, in their circuit, and distempered variously with putrefaction ; forasmuch as the Spirits, residing in either Liquor, especially in the Blood, are no sooner profligated, by the blast of this malignant Disease, but a coagulation is induced to the remaining Liquor, even as milk growing sour, or when some acid juice is poured to it ; wherefore, portions of it being more grievously touched with the Poyson, they soon curdle or grow into gobbets, and suffer corruption with blackness, like Blood out of the Vessels ; from whence, presently they hinder the motion of the rest of the Blood in the Vessels, and in the Heart, and by means of its ferment, more coagulate it ; but whatsoever by congelation grows into curdled gobbets, unless it be presently cast out of doors, causes death quickly, by restraining the circulation of the Blood ; and being thrust forth outwardly, towards the superficies of the body, it is stopped in its motion, between the narrow windings of the Vessels ; and being wholly destitute either of Spirit, or being struck by a blasting, produces its deadness, black and blew spots, and black or purple marks ; or, by reason of the Salt and Sulphur, being exalted, by the pestilential ferment, and affecting new things, grow together into tumors of a various kind.

A Carbuncle, or Fiery Inflammation, is a fiery Tumor, with most sharp and burning Pustules round about it; and infesting the sick, with an acute pain; which arising in various places severally, will not be ripened, but creeping more abroad on the superficies, burns the skin, and at length shakes off the lobes, or gobbets of its Corruption, and leaves an hollow ulcer, as if burnt by an Escharotick or burning Plaster.

The generation of Plague-sores, seem to be made after this manner, when Poysonous infections do strike into the Blood, in its own nature torrid, portions of it congealed, are fixed in the superficies of the Body; and in that place, because the motion of the Blood is a little hindered, a tumour at first small, is induced; which afterwards, by a malignant ferment, unfolding it self more largely, being leisurely increased, creeps into the neighbouring part: A suppuration follows not, because the matter being extravasated, and stagnating, is not concocted and digested by a gentle heat, but by reason of the particles of the outrageous Sulphur, together with the carried forth Salt, being heaped up in these Tumors, and because of the stagnation, they being presently loosened from the mixture, a burning is excited, as if a Cautery were affixed to the part: pieces and lobes of skins, eaten as it were from a covered Eschar, fall off, because the Corrosive venom, impacted in the Muscles, gnaws not only to the superficies, but those that lie transvers through the whole substance; wherefore, before all the flesh is consumed, with the membranes, in which the eaten pieces were involved, some piece, as it were cut off from the rest falls away. A Carbuncle, oftentimes but one, oftentimes more arise: sometimes they are alone, sometimes they are accompanied with a Bubo.

A pestilent Bubo springs forth, only in glandulous places, into whose substance goes, not only the Blood congealed by the Poyson, and carried through the Arteries, but the nervous juice heaped up there, and carried back into the Veins. Because this Tumor happens from less torrid juices, and in part more frigid, therefore it partakes of suppuration. For the matter being leisurely heaped together, when (by reason of the stagnation, the vital Spirit being departed) it had lost the form of Blood, it was by a long concoction converted into matter, from the particles of Salt and Sulphur exalted, and restrained in the Tumor. But that these Tumors only happen in the Glandulas, the reason is, not that by the destination of Nature, the nest or tinder of the Disease, is carried to these parts, but as the particles of the virulent infection, abound every where in the Blood, and nervous juice, they are more readily gathered together, as in a common Family, and where the Blood being dilated to the extream parts of the Arteries, and is so not readily received, and carried back by the veins, and also the alible juice, to be carried back from the nerves, into the veins, is deposed: either of these, as it appears clearly, by late observations of Anatomists, and by experience, are made or done about the Glandulas; wherefore, when in these parts, either humors, being stuffed with the pestilent seeds of the contagion, come together at once, as it were the nest of the malignity, because of the virulency here deposed from either, is blown up.

Whelks, fiery inflammations, and purple spots, in respect of the venom, are of the same stuff, as the Tumors but now described: but in these, the product of the virulency, consists in a lesser substance, yet with greater danger, by reason of the seeds of the Poyson, being more dispersed: more small portions of the coagulated Blood being fixed in the skin, constitute these lesser appearances, wherefore, out of these, some being increased, are ripened into little itching blisters: others, by reason of a certain blasting, or deadness of the corrupted Blood, grow into black and blew, and purple Spots.

Altho the Plague, by reason of its sudden, secret, and very swift assault upon sick people, hardly gives time or place, for a prognostick, and when this Disease, by reason of the occult manner of hurting, contains in it self nothing that is not suspected, yet there are some signs, that appear in its course, by which we are wont to foretel, either Life or Death. The business is then desperate, if the Disease pass presently into an Epidemical distemper, and makes violent assaults; if that bleeding, or only a small sweat follows, in the beginning of the Disease; if the Urine be thick and troubled, the Pulse unequal, and weak; if a Convulsion, or a Phrensie presently follow; if the Vomits, or Stools are blewish, black, or highly stinking; if the Whelks at first contract a redness, afterwards a blueness; if the Carbuncles are many; if the Buboës at first swelling up, disappear; if strength be suddenly lost, the face horrid, or grows black and blew; if with a shivering of the outward parts, there be an heat of the bowels, especially if these, or many of them happen in a body full of ill humors, or in an unwholsom season. On the contrary, the sick may be bid to be of good cheer, if the condition of the Pestilence be lighter, and less deadly; if the Disease happens in

a robust and healthful body, with a strong mind; if remedies may be timely had, before the Disease hath possessed the whole mass of Blood. Also, if with a continuance of strength, high and equal Pulse, a suppuration of the Buboës, and a large profusion of matter, with the absence of more horrid Symptoms, the course of the Disease is performed: In the mean time, altho here we may hope all good, yet we are not to be secure, because, sometimes the snares of life, are laid privily, with the laudable appearance of signs, and we suffer most grievously as from a reconciled Enemy, whose fierce threatnings we seemed to have shun'd.

Concerning the curing of very many sicknesses, the business is chiefly committed to Nature, to whose necessity, Physick is the Midwife: and the office, and science of a Physician, chiefly is busied in these, that occasions of giving convenient aids, to this labouring, be attended, but the Plague hath this peculiar, that its cure is not at all to be left to Nature, but that it is to be endeavoured any way, by remedies gathered from Art. Nor are we to be solicitous of a more opportune, or as it were a gentler time, but Medicines are most quickly to be prepared, and we must not stay for them some hours, no nor minutes. But because, whilst the Pestilence reigns, there is no less need of cure, that the Contagion may be driven far away, than that the Disease being impressed may be cured, therefore, a double task is incumbent on the Physician, to wit, that he looks to the prevention of this malignant Disease, as well as to the cure. To prescribe a method for both these, had been a work of too much tediousness, and to have given you a dish a thousand times dressed by Authors, wherefore, we will only touch lightly here, some chief Indications, and hast to other things.

Preventive cautions, either respect the Republique, and belong to the Magistrate; or private persons, to whom it should be taught, what is to be done by all men, when the Plague is feared.

The publique care in the time of the Plague, consists chiefly in these, that Divine worship be truly observed, that all nests of Putrefaction be cut off, That filths, Dung-hills, and all stinking things may be removed out of the Streets, and all occasion of the Contagion diligently avoided, and that an wholsom means of living be constantly observed by the Citizens. For which end, the use of fruits, and of other unwholsom things should be interdicted: that poor people, who have not plenty or choice of food, should be provided for, at the publique charge: If still the Pestilence begins to spread, the empoysoned force of the Air should be corrected, as much as may be, which may be best done, by the frequent burning of Sulphurous things; the infected should be separated from the sound, and the dead Carcasses, and household-stuff should be avoided; and lastly, that able and fit Physicians, and Ministers be provided for the use of the sound, and the necessities of the sick.

The preventive means of a private person, is wont to be concluded in these three things, *viz.* Diet, Physick, and Chirurgery. Diet respects the six nonnatural things, among which, of the greatest moment are, the Air and passions of the mind: as to the rest, *Hippocrates* his precept may suffice, *viz.* Labour, Meat, Drink, Sleep, *Venus*, should be taken moderately. The Pestilent Air should be avoided, by going into some other place; or corrected by the well burning of Sulphureous things, or whilst we breath it should be cured by fumigations and sweet smells, often carried near the nostrils. As to the passions of the minds, fear, and sadness, whilst the Pestilence rages, are as it were another Plague; for in these, the seeds of the envenomed Contagion, which are placed in the superficies of the Body, as it were on the edge of a whirlpool, are snatched inwardly, by a certain force, and carried to the Heart; wherefore, tis a most excellent Antidote, to be of a chearful and confident mind. I have known many, who (as *Helmont* was wont to say) by fortifying the Archeus, with Wine and confidence, never used any other Poyson resisting Medicines, and remained without any hurt of the Contagion among the infected: and on the contrary, some struck with fear, when they have dwelt far from all Contagion, have drank in the seeds of the Pestilence, as if they were derived from the Stars.

Among the Chirurgical things, to be administred for preservation sake, are wont to be commended, the opening of a Vein, Cauteries, and Amulets. Where there is a fullness, with a great swelling up of the Blood; or in those who constantly, by long custom are wont to be let Blood, it is convenient to open a Vein: For the less the Blood grows hot, and is circulated without Tumult, in the Vessels, it will be so much the longer, ere it be contaminated, by the postiferous Disease. Issues made by Cauteries, are so much used, almost by the suffrage of all, for preservation sake against the Plague, that tis become the most common receipt: For these by a constant transmission pour forth the assiduous coming of the superfluous and excrementitious matter; and if
that

that the infections of the Pestilence be admitted inwardly, they are cast forth of doors, at these open ports.

Amulets, hung about the neck, or born on the wrists, are believed to have a wonderful force against the Pestilence; of these, among some, of the greatest esteem, are such as are made out of Arsnick, quick-silver, the powder of Toads, and other Poysons. That the same in this case may be profitable, besides the observations of Physicians this reason may seem to persuade something. The *Effluvia*, or atomical little bodies, emerging now from these bodies, now residing upon these, are before affirmed to fly about through the whole Region of the Air; these, as they are diversily figured, some of them easily cohere with others, but if they strike against some of another form, they oppose and overturn them: hence, the particles of the pestilent Infection, which are adverse to our Spirits, excellently agree with those little bodies of Poyson placed near, and are readily fixed to them: wherefore, the Amulets made of Poyson do this, *viz.* They receive the seeds of the Pestilence meeting us, into themselves, by reason of the likeness of parts; also, by alluring the same from our bodies, into their embraces, they in some measure, free the infected from the infection.

The Medicinal prevention hath a twofold scope: First, that the assiduous coming of the excrementitious matter or humors be taken away by a gentle purging, as often as there is need: Secondly, that by the daily taking Poyson-resisting Medicines, our Spirits, and Body may be fortified against the assault of the Poyson: By the former, the Food and cherishers, of which encrease putrefaction brought in by the Poyson are drawn away; by the latter, the first inkindling of the pestiferous Infection, as it were a deadly fire, is inhibited. Alexipharmies or Medicines contrary to Poysons seem to be helpful against the contagion of the Plague for this twofold Reason; Both because the mass of Blood and Viscera being filled with the particles of these, and also the Spirits before possessed with the same, they do not easily admit of the company of the impoysoned Infection; also, because the Blood being incited by the gentle fury of these is kept from coagulation.

Thus much for preservation, it follows now, that we speak of the cure of the Plague. The doctrine of which, is either general, and comprehends remedies, which for this end, are taken from Diet, Chirurgery, and Medicine; or special, which delivers the use, and Cautions to be exhibited, about those Remedies; and by what means we are to oppose the Symptoms variously arising.

Diet comprehends the use of the six non-naturals, but the chief care, and medical cautions, are to be given about eating, the primary Indications of this, consist not at one and the same time together, but ought to be supplied by turns, according to the nature of the thing, and the exigency of nature. In respect of the malignity, and of the loss of strength, Aliments are to be desired, which greatly cherish the Spirits, and bring a more plentiful nourishment: in respect of the Feaverish distemper, a more slender refrigerating Diet, and temperating the Blood, seems to be required: The Physician must regard either, but he may rather intend his Remedies against the malignity, than the Feaver.

The helps that belong to Chirurgery, are the opening a Vein, which seldom and very cautiously ought to be used in this Disease, because the Blood being too much exhausted, and the Vessels falling down, sweat is not so easily procured; instead of this, it is better to use Cupping, with scarification. For this, and Blistering, are rightly applied for the drawing forth of the Venom; moreover, against Buboës, Inflammations, or malignant Ulcers produced by them, Cataplasms, Fomentations, Plasters, Oyntments, and many other things, to be outwardly applied, are to be sought for from Chirurgery, in which some Poysons, as the Electric of Poyson, are prescribed by some to be admixed; wherefore, preparations of Arsnick, to wit, the oil and balsom of it, are commended by many, in this case too of most excellent use and efficacy.

Medicines for the cure of the Plague, are either Evacuators, or Poyson-resisters: The intention of the former is, that the serous Latex in the Blood, and the excrementitious humors, which abound in the Viscera, be thrust forth of doors; and together with them, very many particles of the invenomed Infection, every where dispersed in the Body: But these are both Vomitories and Purgers, the use of which is more rare, and only in the beginning of the Disease, also Diaphoreticks or sweating Medicines, which at some times may be suffered according as there is strength, are to be prescribed in the Plague: For these more fully, and from the whole body at once evacuate, yea, and by agitating the Blood, defend it from Congelation, and as they move from the Center, still to the Circumference, they drive the impoysoned ferment, also the Corruptions of the Blood and humors, far from the heart, and so chase the Enemy with-

out the Camp. But Vomits, and Purges evacuate less universally, and by Concentrating the malignant matter, oftentimes carry it inwardly, and fix it to the Bowels. But these Medicines, whether they operate by purging, or sweating, ought to be of that kind, which have particles, rather agreeable to the empoysoned infection, than to our Blood or Spirits; for such a Medicine, will pass through the various windings of our body, with its whole forces and unmixed, and by reason of the similitude of either, more certainly takes hold of the virulent matter of the Disease, and carries it forth of doors with it self, by the mutual adhesion of the parts, which way provoked nature leads. Wherefore, Medicines, whether Catharticks or Sudorificks, are commended before others, which are prepared out of Mercury, Antimony, Gold, Sulphur, Vitriol, Arsnick, and the like; which, when they cannot be subjugated by our heat, or mastered, become the best Remedies against the Poyson of a pestilent Disease: for these do not only potently evacuate superfluous things, but when as they put forth very strong and untameable particles, and explicate them every where in the body, dissipate the ferments of the Poyson growing here and there, and hinder them from maturation; and as these Remedies, being of themselves not to be overcome by Nature, are necessitated to be carried outwardly through the open passages of the body, they carry forth of doors with them, whatsoever extraneous or hostile thing is met with.

As to Poyson-resisting Medicines, or Alexiterians; which are said to resist the Poyson of this Disease, without any sensible evacuation, they are (for the most part) such, whose particles are not very much of kin to Nature, so as to goe into Aliment; nor so diverse, as to provoke to an excretion. The same being inwardly taken, and broken into the smallest pieces, inspire the Blood, and juices flowing together in the Vessels, and Viscera, with their little bodies, as with a new ferment, and by moving the same gently, and by keeping them in an equal mixture, defend them from Coagulation, and Putrefaction; dissipate the particles begun to be heaped up, one from another, by the same gentle agitation, and hinder them from maturity; and lastly by prepossessing the Blood and Spirits, defend them from the impressions of the pestilent mark. Among these, some more simple Remedies are commended as Rue, Scordium, &c: but most of all by far are esteemed, those that are compounded, wherefore, Treacle, Mithridate, and Diascordium, some of which are compos'd of no less than fifty simples; that, 'tis esteemed a crime in Medicines so compleat in all numbers, to omit one Plant, or one Dram of them in their Compositions; the reason perchance is, because very many things being put together, may make a mass, whose diverse kinds of particles being exalted, by long digestion, may stir up the greater fermentation in our Blood and humors.

Having after this manner ranked the Remedies, in which we ought to be instructed, for the curing of the Plague; now next we should speak of the method of cure, *viz:* What first, and then what next, should be done in order: but that this Disease hath so precipitous a Course, that there is neither place for deliberation, nor is there frequently any Physician to be gotten, for fear of the Contagion; wherefore, there is no need here of many prescripts, or a long series of Indications; this business is to be quickly performed, and may be comprehended in a few things. Therefore, when the pestilence reigning, any one is distempered with the Contagion of this Disease, the help of the omnipotent God being requested by Prayers, presently Remedies are to be flown to: If the Plague happens in a body not thoroughly purged, and prone to Vomiting, presently let a Vomit be taken, whose operation being finished, immediatly let a sweat be provoked, by taking Diaphoreticks, and the same continued as strength can bear it, and afterwards be often repeated. Besides, let Alexipharmicks or Poyson-resisters, be used almost every moment, until by the eruption of Wheelks, Inflammations, or Buboës, all the Venom be wholly driven forth of doors: but in the mean time, proper and respective Remedies, are to be opposed to the most urging Symptoms: but especially, fit helps are to be sought from Chirurgery, for the cure of the Buboës, and Plague-sores: the whole weight of this business, leans on these two Intentions, that the pestiferous Poyson may be every way expelled from within, and then, that the recourse of what is driven forth, be with equal diligence prevented.

Concerning the Plague, we cannot so readily write examples, and histories of sick persons, with exact diaries of the Symptoms: because these kind of sicknesses came not every year, neither when they spread, is it lawful for every Physician that takes care of his own health, frequently to visit the sick, or to stay long with them, whereby he may denote all accidents, and diligently consider the reasons of them; which task however, the renowned Diemerbrochius, did so firmly persist in, that after him, others may

may lawfully be superseded from this work : when sometimes past, in this City, viz. 1645. the Plague (tho not great) had spread, Doctor *Henry Sayer*, a very learned Physician, and happy in his practice, many others refusing this province, boldly visited all the sick, poor, as well as rich, daily administered to them Physick, and handled with his own hands, their Buboes, and virulent Ulcers, and so cured very many sick, by his sedulous, tho dangerous Labour. That he might fortifie himself against the Contagion, before he went into the infected houses, he was wont only to drink a large draught of Sack, and then his perambulation about the borders of Death, and the very jaws of the Grave being finished, to repeat the same Antidote ; After he had in this City, as if inviolable as to the Plague, a long while taken care of the affairs of the Sick without any hurt, he was sent for to *Wallingford-Castle*, where this Disease cruelly Raged, as another *Æsculapius*, by the Governour of the place : But there being so bold, as to lye in the same Bed, with a certain Captain (his intimate Companion) who was taken with the Plague, he quickly received the Contagion of the same Disease : nor were the Arts then profitable to the Master, which had been helpful to so many others, but there, with great sorrow of the Inhabitants, nor without great loss to the Medical Science, he dyed of that Disease. As to others, distempered by the Pestilence, he was wont to order this kind of method of healing, if he was sent for before the Buboes or Wheelks appeared outwardly, for the most part he gave a Vomit, the prescriptions of which were of the Infusion of *Crocus Metallorum*, sometimes with white, and sometimes with Roman *Vitriol* : The Vomiting being ended he commanded them to be presently put into a sweat by the taking of Diaphoreticks ; and thence, some intervals being granted, for the recovery of strength, the sweating to be continued to the declination of the Disease : but if he were sent for to the sick, after the appearances of the marks, the Vomiting being let alone, he insisted only upon Sudorificks.

C H A P. XIV.

Of Pestilential and Malignant Feavers in specie, and of others Epidemical.

AFTER having unfolded the Nature of the Plague, by the order of our Tract, we ought to proceed to the Diseases, which seem to be nearest like its Nature ; which chiefly are Feavers, called Pestilent and Malignant ; for tis commonly noted, that Feavers sometimes reign popularly, which for the vehemency of symptoms, the great slaughter of the sick, and the great force of contagion, scarce give place to the Pestilence ; which however, because they imitate the type of Putrid Feavers, and do not so certainly kill the sick as the Plague, or so certainly infect others, they deserve the name not of the Plague, but by a more minute appellation of a Pestilential Feaver : Besides these, there are Feavers of another kind, the perniciousness and Contagion of which appear more remis, yet, because they are infectious, beyond the force of Putrid Feavers, and seem to contain in themselves in a manner, the *Τὸ Θεῖον* or hand of God of Hippocrates, are yet by a more soft appellation, called Malignant Feavers.

Those Feavers differ both from the Pest, and from one another according to the degree, and vehemency of contagion and deadliness : as the Plague is a Disease highly contagious, and deadly to human kind ; tis the Pestilent Feaver, which commonly spreads with a lesser diffusion of its infection, and frequency of burials. When the infection is only suspected, and the Crisis happens beyond the event of vulgar Feavers, only not to be trusted or less safe, tis esteemed for a Malignant Feaver. They are yet more fully described thus.

When the Feaver commonly spreads abroad, which for the variety of symptoms, puts on the likeness of the Putrid Feaver so called, to wit, when there are present, Thirst, Burning, Weariness, Anxiety, roughness of the Tongue, Watchings, Phrensie, Vomiting, want of Appetite, Syncopy, Swooning, Heart-pains, and a concurrence of other most terrible accidents ; if there happen besides, spots either like to the little Flea-bites, or broad ones like black and blew strokes, and livid, we esteem this disease of an evil Nature. If besides these, it is not cured after the wonted manner of

Feavers, but that the strength of the sick is cast down, without any manifest cause, and that death comes often unlooked for and unsuspected, against the Prognostic of the Physician, there is yet a greater cause of suspicion of malignity: But if it kills very many of the sick, and that those who converse with the sick, contract the evil of the same Disease, that the same Disease spreads through all the Villages or Cities, it may be said to be more than malignant, a pestilential Feaver; which is yet fully proved, if it rages in very many ordinarily with a certain common symptom, as when a Squinancy, Dysentery or deadly Sweat, such as in times past spread in *England*, accompany these sort of Feavers.

If that a Feaver arises, which Distempers many living in the same Region together, almost after the same manner, which notwithstanding observes the laws of a common Putrid Feaver in its course, and is cured almost after the same manner, this is not said to be Pestilent, but only a Malignant Feaver; unless that in some labouring with a remarkable Cacochymy, or fulness of ill humors, the appearances of Buboes, or of spots, sometimes with a deadly Crisis, and a contagion creeping upon others, betray some signs of Malignity.

If it be demanded, to which Class of the aforesaid Feavers, these sort of Pestilential and Malignant Feavers ought to be placed, we ascribe them only to the rank of continual Feavers; we discharge or acquit intermitting Feavers, because by intervals they grant such firm Truces to Nature, and then they regularly and exactly observe their periods, which does not consist with an invenomed disposition. Also we except Hectic Feavers from malignity, because otherwise their mortality would not be so long delayed, but that partaking of Poyson, they would kill sooner: among continual Feavers, altho we affirm, that the simple synochal Feavers, are not free, yet they are rarely touched with this evil: but most of all, the Feaver which shews the notes of pestilency or malignity, is of that sort, which resembles the figure of the Putrid Feaver so called: for when in these Feavers, besides the appearances of virulency, we perceive a continual growing hot of the Blood, which passes through the courses or stadia of beginning, increase, standing and declination, as in Putrid Feavers, we deservedly affirm here, the Sulphureous part of the Blood to be heated and inkindled, and by its burning to have brought in the Feaver: wherefore in these kind of Feavers, two things are especially to be noted, the growing hot of the Blood and the malignity joyned with it, of which now this, now that is the greater: also, in both there is a great Latitude, and very many degrees of its intension or heat, according to which the Feaver becomes more or less acute or malignant.

The growing hot of the Blood is performed after the same manner, as is already said concerning Putrid Feavers: to wit, the Sulphureous part of the Blood growing hot above measure, as it were takes fire by its fervor; in the time of its burning it accumulates a great quantity of adult matter, upon whose subaction and seclusion, depend the state and Crisis after the wonted manner of Feavers: but besides these, the Blood being infected with a certain venomous taint, in the burning it begins by reason of the malignant ferment, to be coagulated into parts, and to putrifie: wherefore besides the usual symptoms of the common Feaver, by reason of some congealed portions of the Blood, follow either deadly Distempers, Swooning, a dejection of the Spirits, also appearances of spots and marks: besides venomous *Effluvia*, which depart from the sick, that are able to raise up the like Distemper in others, by the force of their contagion; wherefore by reason of its perniciousness and contagion, and their various degrees, it is called, either a Pestilent or Malignant Feaver.

Also whilst the Blood growing hot, is infected with a venomous and malignant ferment, not only proper coagulations of its mass, with a disposition to putrification, are induced; but also the Nervous Liquor, easily contracts the taint of this, from whence it being made impropportionate to the Brain and Regiment of the Animal Spirits, stirs up great irregularities in them: wherefore upon these sort of Feavers, come not only spots and wheals, but most often a Delirium, Phrensie, Sleepiness, Tremblings of the Limbs, Cramps, and Convulsive motions; I have often observed, that in some certain years, Malignant Feavers have increased, which have shown their virulency, without the appearances of marks, chiefly about the Nervous stock; because in some, presently after the beginning, has followed a sleepiness, with a mighty heaviness of the Head, in others, strong Watchings, a perturbation of mind, with Trembling and Convulsive motions, but in most, either none, or only an uncertain Crisis, and instead of it, a translation of the Feaverish matter to the Brain; besides it is observed, that these Feavers creep upon others by contagion, and that very many are killed by them, that therefore they do deserve to be called Malignant.

But

But these kind of Feavers are sometimes first begun from a venomous infection, and the Blood being touched with the Particles of the venom, conceives of it self an Effervescency, and is inkindled; as when from a contagion or malignant Air being inspired, any one hath fallen into a Malignant Feaver, without any evident cause or predisposition: But sometimes the Feaverish Distemper is induced from a proper cause, and then the seeds of the Malignity, either lying hid within in the Body, exert themselves in the Effervent Blood, or they come from another place by the contaminated Air, as it were the Food of the flame before inkindled; for it appears by frequent observation in the time in which an Epidemical Feaver spreads, that others being any way arisen, turn into it.

Malignant Feavers, as also Pestilential, for the most part are popular, and invade many at once: but sometimes they are private, and not ordinary, so that perhaps only one or two are taken in the whole Region; in such a case, it is to be suspected that they come not from a malignant Air, or Epidemical cause, but from a morbus provision of the Body; for I have often observed that when in the Spring or Autumn, a Feaver sufficiently common, hath spread in some City or Town, of which very many have dyed, perhaps some one on whom an evil predisposition, and a more strong evident cause, hath brought the Feaver, hath lain by it, with more horrid symptoms, and great notes of malignity: in which case that malignity is not to be called common to the Feaver, but not ordinary, and accidental only.

Altho the greatest reason of the difference, by which these kind of Feavers are distinguished from one another, and from other Feavers, consists in their deadliness and contagion; yet sometimes, they are noted with a certain peculiar symptom, from which they take for that time, both the note of malignity, and the appellation of the name: hence in some years an Epidemical Feaver reigns, which induces to most of the sick a Squinancy, another time an inflammation of the Lungs, a Pleurisie, Dysentery, or some other distemper, and that oftentimes most dangerous, and contagious: so the seeds of Diseases, not only derived from the Parents by tradition, excite their fruits as it were by a certain designation, in the same part or member; but also, those received from an Infection commonly spreading, produce in all, a distemper of the same mode and figure: which yet I think to happen, not because the seeds of the venomous Infection, respect either this or that Region of the Body, with a certain peculiar Virtue; but these so affect the mass of Blood, by a like manner in all, that there is a necessity, for the sake of washing away this stain, that a Crisis be attempted after the same manner in all. For when, without malignity, the Blood, by reason of Coagulation, or perhaps other causes, is apt to be extravasated, the usual places, in which portions of the same being extravasated, are wont to be fixed, are the Throat, Pleura, Lungs, and Intestines: wherefore, 'tis no wonder, when from a malignant cause, the congelation of the Blood, and for that reason an extravasation is induced, if the Disease is nested in the accustomed cherishing place of Nature.

Concerning the causes of these kind of Feavers, there is not much business: they are for the most part deduced, in respect of the malignity, from the vicious Constitution of the Air; in respect of the Feaverish heat, from the morbus provision of the Body: either of these, are easily made clear, by what hath been already said, concerning a Putrid Feaver, and the causes of the Pestilence: If the malignity be stronger than the Feaver, and hath induced it, the impression of it is to be imputed to the inspired Air, or to a Contagion received from others; if the Feaver be first, its inkindling is ascribed to transpiration being hindered, to a Surfeit, or to some other of the evident causes above enumerated.

As to the signs, besides contagion and destruction, these shew the malignity of the Feaver, a sudden loss of strength, a weak and unequal pulse, and evil affection of the Brain and nervous parts, being suddenly induced, cruel Vomitings, blackness of the Tongue, a suffusion of darkness through the whole Body, but chiefly the appearances of Spots, Buboës, and of other marks.

For the cure of Feavers, both Pestilential and Malignant, there is greater need of Judgment, and Circumspection, than in any others whatsoever: For when there are two primary Indications, to wit, the Malignity, and the Feaverish intemperance, and when one can scarcely provide for the one, without detriment to the other, it is not easily to be discerned, which should first be helped, or soonest regarded. In respect of the Feaver, purging, opening a Vein, and cooling things, do chiefly help; but whilst these are performed, the Malignity, for the most part is increased, and being neglected, spreads abroad more largely its Poyson: against the Malignity, Poyson-resisting Cordials, and Diaphoreticks are required, but these extreamly heighten the Feaver, they
more

more shake the Blood and Spirits before inkindled, as it were with the blast of Bellows, and force all as it were into a flame; wherefore, here is great need of skill, that these things be rightly ordered in themselves, and where there is most of danger appearing, thence the Curative Intentions are to be more immediatly designed; but so, as whilst one is consulted about, the other be not neglected. But in these cases, besides the private Judgment of every Physician, experience may supply the chief means of healing: for when as these Feavers first spread, every one almost tries several Remedies, and by the success of them collated together, it may be easily reckoned, what kind of method is to be relied on, till at last, by a frequent tryal, or the footsteps of those passing before, there is made as it were a high and broad Road, for the curing of these sorts of distempers, bounded both with various observations and warnings.

Besides these sort of Feavers, which spread on many at once, and by reason of the Contagion, deadliness, and conspicuous notes of virulency, deserve to be called Pestilent or Malignant; there are some others, epidemical or popular, which almost every year, either in the Spring or Autumn, rage in some Countries; of which the Inhabitants for the most part of them are wont to be sick, and not few, especially of the Elder, to dye: In which notwithstanding, no signs of Pestilence or Malignity appear, neither does the Disease seem to spread, from one and so to another, so much by Contagion, as to lay hold on many, by reason of a predisposition, impressed almost on all. But these kind of distempers, depend chiefly upon the foregoing Constitution of the year: for if the season going before was very intemperate, by reason of excess of cold or heat, of dryness or humidity, and so had continued for a long time, it changes our Blood very much, from its due temperature, whereby it is apt afterwards to conceive Feaverish effervescencies; and from hence a Feaver, now of this Type or Figure, now of that is produced; which presently becomes Epidemical, because it draws its beginning from a common cause, wherewith the bodies of all, are in a manner affected: But such Feavers, forasmuch as they depend upon the Blood having gotten a disposition, now sharp, now austere, or of some other kind, by reason of the temper of the year, for the most part are of the rank of intermitting Feavers: yet, by a proper provision of Symptoms, they are wont to be noted, according to the peculiar Constitution of every year. These are not able to be comprehended, under a certain common rule, or formal reason, which may quadrate to the nature of each of these; because they vary every year, according to their several accidents. However, we will give you the descriptions of these kind of Feavers, spreading of late years in this Region, had at that time, for some specimen of the rest, and add it for a conclusion at the end of this Tract.

There yet remains to be ascribed to the rank of malignant Feavers, some other private Feavers, and participating of no Contagion: of which sort chiefly are those, which are wont to happen to Child-bearing women, by reason of difficult and hard labour, or by reason of the stoppage of their Courses. Indeed it sufficiently appears, by common observation, that these are very dangerous, and often mortal: for if, by the parts of the Womb being hurt, or by cold being admitted, or perhaps by any other cause, the Courses are stopped, and the humour which ought to be thrust forth, shall be confused with the mass of the Blood, it most wickedly infects it, as it were with a certain venomous mixture; that by that means, presently a Feaver is excited, which with an evil provision of Symptoms, is very much beset, *viz.* with heat, and cruel thirst, Vomiting, pain of the Heart, and watchings, and for the most part obtains, either no Crisis, or a very difficult one: because, unless the wonted way of the flux of the Courses, may be at length restored, it is wont, after the heat of the Blood hath been continued for some days, to Communicate the evil to the Brain, and nervous stock; from whence, by and by, a Delirium, Phrensie, Convulsions, and other most wicked distempers, are most often induced, which do not seldom end in Death: but these sort of Feavers deserve a peculiar consideration which we have more fully determined to shew hereafter in a particular discourse concerning this business; in the mean time, we will undertake to propose some instances or examples of the Feavers, but now delivered, *viz.* of the Pestilent, and Malignant.

The pestilent Feaver, of late years, hath more rarely spread in these Regions, than the Plague it self: of the only one of this kind, which fell under our observation, I will give you a brief description. In the year 1643, when in the coming on of the Spring, the Earl of *Essex* besieged *Reading*, being held for the King, in both Armies there began a Disease to arise very Epidemical; however, they persisting in that work, till the besieged were forced to a surrender, this Disease grew so grievous, that in a short time after, either side left off, and from that time, for many months, fought not with the

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Enemy, but with the Disease: as if there had not been leisure to turn aside to another kind of Death, this deadly Disease increasing, they being already overthrown by Fate, and as it were falling down before this one Death. *Effexe's* Camp moving to the *Thames*, pitched in the places adjacent, where he shortly lost a great part of his men: But the King returned to *Oxford*, where at first, the Souldiers being disposed in the open Fields, then afterwards among the Towns and Villages, suffered not much less: For his Foot, (which it chiefly invaded) being packt together in close houses, when they had filled all things with filthiness, and unwholsom nastiness, and stinking odors (that the very Air seemed to be infected) they fell sick by Troops, and as it were by Squadrons. At length the Feaver now more than a Camp Feaver invaded the unarmed and peaceable Troops, to wit, the entertainers of the Souldiers, and generally all others, yet at first (the Disease being yet but lightly inflicted) tho beset with an heavy and long languishment, however many escaped. About the Summer Solstice this Feaver began also to increase with worse provision of Symptoms, and to lay hold on the Husbandmen, and others inhabiting the Country. Then afterwards, spread through our City, and all the Country round, for at least Ten miles about. In the mean time, they who dwelt far from us, in other Counties remained free from hurt, being as it were without the sphere of the Contagion. But here this Disease became so Epidemical that a great part of the people was killed by it; and as soon as it had entred an house, it run through the same, that there was scarce one left well to administer to the sick; strangers, or such as were sent for to help the sick, were presently taken with the Disease; that at length, for fear of the Contagion, those who were sick of this Feaver, were avoided by those who were well, almost as much, as if they had been sick of the Plague.

Nor indeed, did there a less mortality, or slaughter of men, accompany this Disease: because Cachectic, and Pthical old men, or otherways unhealthful, were killed by it; also not a few of Children, young men, and those of a more mature and robust age. I remember in some Villages, that almost all the old men dyed this year, that there were scarce any left, who were able to defend the manners and priviledges of the Parish, by the more anciently received Traditions.

When this Feaver first began, it was something like the figure of a putrid Synochus; but it was harder to be cured, and when it seemed to be helped by a sweat or looseness, presently it was wont to be renewed again: but for the most part, after the deflagration of the Blood, continued for six or seven days, this remitting, and instead of a Crisis the adust matter being translated to the Brain, the sick for a long time keeping their Beds with raging sometimes, but more often with a stupefaction, with great weakness, and sometimes with Convulsive motions, scarcely escaped at last. About the middle of the Summer, besides the Contagion and frequent burials, this Disease betrayed its malignity, and pestilential force in open signs, *viz.* By the eruption of Wheals and Spots: because about this time in many there appeared without any great burning of the Feaver, an unequal, weak, and very much disordered pulse; also without a manifest expense of Spirits, their strength presently became languishing, and very much dejected: In others, sick after the same manner, appeared little Blisters or Measles, now small and red, now broad and livid: in many, Buboes, (as in the Plague) about the glandulas: of these some died silently and unforeseen, without any great strugling of the Spirits, or Feaverish burning excited in the Blood: in the mean time others, by and by becoming furibundous, whilst they lived suffered most horrid distractions, of the animal Spirits. Those about to escape from this Disease, without any laudible Crisis, (unless they were the sooner freed by a sweat provoked by Art) the Brain, and nervous stock becoming disordered, at length, with a benumbedness of the senses, tremblings, vertigo, debility of the members, and Convulsive motions, did not grow well but of a long time after. During the Dog-days, this Disease being still infectious, began to be handled not as a Feaver, but as a lesser Plague, and to be overcome only by Poyson-resisting Remedies; letting of Blood, was believed to be fatal to this: Vomits, and Purges, sometimes tho not often, were made use of, but the chiefest means of Cure, were accounted to be procured by Alexiteriums, and timely sweat. For this end, besides the prescripts, of Physicians, to be had at the Apothecaries, some Emperical Remedies deserved no small praise; then first of all, the powder of the Countess of *Kent*, began to be of great esteem in this Country; also of no less note was another powder, of the colour of Ashes, which a certain Courtier staying by chance in this City, gave to many with good success; and to others approving of the use of it, he sold it at a great price; the sick were wont having taken half a dram of this, in any Liquor, to fall into a most plentiful sweat, and so to be freed from the virulency of the Disease;

Disease; That Diaphoretick (whose preparation I afterwards learnt, from the Cousen German of the Author) was only the powder of Toads, purged thoroughly with Salt, and then washed in the best Wine, and lightly calcined in an earthen Pot. The Autumn coming on, this Disease by degrees remitted its wonted fierceness that fewer grew sick of it and of them many grew well; till the approach of the Winter, when this Feaver almost wholly vanished, and health was rendred to this City, and the Country round about fully and wholly.

Thus you have seen the beginning, progress, and end of this Feaver, at first only a Camp Feaver, but at length became Pestilential, and Epidemical. That at first the Disease began in the Souldiers Camp, may seem to be imputed, not only to their nastiness, and stinking smells, but in some sort to a common vice of the Air, for as these Feavers come not every year, their original may be ascribed, partly to the peculiar Constitution of the year. Because, by that means, a more light intemperance of the Air being contracted, tho it did not affect the more healthful Inhabitants; yet in the Army, where evident causes, *viz.* errors in the six non-naturals, very much happen to the general procatartic cause, there is a necessity for these kind of sicknesses easily to be excited. For the constitution of this year, was in the Spring very moist, and slabbery, almost with continual shours, to which a more hot Summer succeeding, and the infection of the Feaverish Contagion here first increasing, still grew worse, and disposed all Bodies the more for the receiving it; wherefore, that this Disease was almost proper to this Region, and at this time Epidemical, the seed of it ought to be ascribed to its first rising from the Army, being quartered round about. But forasmuch, as it afterwards being made Pestilential, and very Epidemical, it infected most of the people living here, and killed not a few, the reason was, the evil affection of the Air; which because of the intemperance of the year being unwholsom, besides by the continual breathing forth of stinking vapours from the Souldiers Camps, and the quarters of the sick, it became at last so vitious, that the infection of the Feaver, being dispersed in it, was greatly exalted, and arose almost to the virulency of the Plague. *Diemerbrochius* relates from the like Camp Feaver, arising in the Summer at *Spires*, afterwards another Malignant and Pestilential, and then the Plague it self to have accrewed. Also, it was a sign that this Feaver of ours, became at last equal to the Plague it self, besides the great force of the Contagion, and the frequency of Burials, most wicked distempers of the Blood, and nervous Liquor, being brought presently upon all, by it: because, strength being suddenly overthrown, the weak intermitting pulse, the creeping forth of measly Blisters, the eruption of Buboes, argued the Coagulation, and corruptive disposition of the Blood: besides the Delirium, Madness, Phrensie, Stupefaction, Sleepiness, Vertigo, Tremblings, Convulsive motions, and divers other distempers of the Head, shewed the great hurt of the Brain, and nervous stock.

That the figure, or Idea of this malignant Feaver, may be painted to the life, very many observations or histories of sick people, are easily to be had; of the many examples of this Disease, I shall only mention a few, which hapned some years since in the house of a venerable man, and as with a mournful slaughter, so not without some admiration.

About the Winter Solstice, in the year 1653. a youth of about Seven years old, without any manifest cause, found himself ill, being troubled with a pain of his Head, Sleepiness, and mighty Stupefaction; with it he had a Feaver, tho not strong, with an ordinary burning, which grew more grievous, only by wandring fits, sometimes once, sometimes twice in Twenty four hours space: presently from the beginning, he slept almost continually, also he was wont in his sleep to cry out, to talk idly, and to leap often out of his Bed; being awakned, and sometimes of his own accord awaking, he presently came to himself, and constantly called for drink; his Urine was red, and full of Contents, his pulse equal, and strong enough; in his wrists appeared light contractions of the tendons, and in his neck, and other parts of his Body, some red spots like Flea-bites. At the first, was ordered a light Purgation, and a frequent taking down of the Belly, by the use of Clysters; he daily took Cordial Julaps, with Poyson-resisters; Vesicatories or blistering Plasters, were applyed to his neck, and other Plasters to the soles of his feet: on the sixth day, a little Blood streamed from his nostrils; on the seventh, without any manifest through Crisis, the Feaver very much abated, the heat so gentle as to be perceived only by the Touch; also, the Urine pale, thin, and without any sediment, yet he was much more grievously troubled with sleepiness, and a stupefaction of the Head, so that his Urine, and the excrements of his Belly came away involuntarily; however, being called upon, he knew the standers by, and answered to their questions; These distempers, notwithstanding the Remedies every day

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grew worse : About the Fourteenth day, the sick youth became so stupid, as neither to be able to understand, nor to speak, yet he swallowed still what was put into his mouth, tho unknowingly, and his pulse was laudable enough : about this time, he fell into a Flux, excited of it self by Nature for four days, which at last ceasing, a whiteish crust or scurf, and as it were Chaulky, began to spread over the whole cavity of his Mouth and Throat, which being often in a day wiped away, new presently broke forth : when he had thus for four days more been sick, he became better in his intellect, and sense, so that he was able to know his Parents and Friends, to take notice of their words, and to do something as he was bid : but as his sensitive faculty began to be restored, so he began to grow worse as to his speech and the Organs of swallowing ; without doubt the matter being fallen from the Brain, into the beginnings of the Nerves, a Palsie in the Tongue and Throat had succeeded to the heaviness and stupefaction : which distemper in a short time so increased, that afterwards the sick person could not swallow at all, but that what he took in at the Mouth presently flowed back again, neither could any thing go down into the Stomach ; when besides the cruelty of the Disease, there was danger lest he should be killed by Famine, an Instrument was prepared of a pin of Chalk, put into a little pliant wand, and on the top of it, a little tuft of silk made fit ; and this being thrust down his Throat, opened the closing for a time, whereby the Food taken in, was suffered to pass, after the use of this for a day or two, he was able to swallow again, and afterwards to take his Food well enough : and within a few days, he began to speak, to discern any thing, and becoming wonderful hungry, to ask for, all day long, all sorts of Food, and greedily to devour whatever was brought to him. In the mean time, by reason of his long sickness, and the Nervous parts being grievously hurt ; he was grown so Lean, that the Bones scarce sticking to the Skin, he represented exactly a living Skeleton. But afterwards, by the sedulous, indefatigable, and prudent care of the Mother about his diet, he recovered perfect Health, and is yet living, and well.

When this child had hardly arrived to the height of his sickness, his Brother, elder about two years, on the Ides of *January*, was taken almost after the same manner. At first he was troubled with a Torpor and heaviness of the Head, then growing Feaverish, with a sleepiness and stupidity : he began to talk idly in his sleep, then being awake hardly to come to himself : after four or five days, these symptoms grew more grievous : he was able to understand little, nor scarce to speak articulately, and not without stammering. His Urine was thick, cloudy, without Hypostasis, or settling of the Contents : there appeared, as in his Brother, red spots, small, like Flea-bites ; his Excrements both of his Belly and Bladder, came away involuntarily. But his Pulse was yet strong and equal ; his Hypochondria were stretched out, and inflated with a tumor of the Abdomen ; about the eighth day, he had a small stream of Blood : on the eleventh day of his sickness, he fell into a Diarrhœa, by which, in the space of five hours, he cast forth seven times, bilous, thin, and highly stinking stuff, from whence there was some hope of his amendment ; but the next day after, the flux of his Belly ceasing, pains, and torments cruelly infested his Belly, that crying out and moaning night and day, he sent forth most heavy complaints ; his Hypochondria and Abdomen were tumid like a Tympany, and mightily distended ; when he could not receive any thing of ease, from no remedies, the most exquisite skill of many Physicians being tried, on the fourteenth day he died Convulsive, in these torments.

A little after his death, *viz.* on the thirteenth of *February*, his Brother, elder than him, about eleven years old, a youth of great hopes, began to be Feaverish ; and as the others, with a Torpor and heaviness of his Head, tho less strongly affected ; but the heat in the Blood was greater, which was of a more hot temperament, and greater perturbation appeared, that for the first six days, besides heat and thirst, he was troubled with a continual endeavour of excretion, now by sweat, now by stool. His Urine was red and troubled ; some red spots, as in the rest broke forth ; on the seventh day he had a bleeding about five Ounces, which ceasing, a great benumbedness succeeded, that for all that day and the night following, he could scarce lift up his Eyes : on the eighth day, a most plentiful bleeding followed again at the Nose, that there was danger, lest he should have lost his life, together with his Blood : the Blood sprang so copiously from his left nostril, that being received in a Bason, it made little Bladders or bubbles by its fall : when he had lost above two pound of Blood, and being taken with a cold sweat, began to lose his strength, remedies were at length administered, and the Flux was yet hardly stopped. The Hæmorrhage being stayed, the Youth slept soundly, and all that day became sleepy : yet often awaking, he remained well in his senses and was quick in sense, and understanding ; and being asked of his health, he said he was pretty well ; his

Urine, which was before red and troubled, then appeared pale, thin, and with a laudable Hypostasis, that the sick seemed, (especial because he wanted thirst, or immoderate heat) to be perfectly cured and freed from the Feaver: on the following morning, being the ninth day of the Feaver, he remained yet torpid, but being raised up, he living chearfully and without intemperance, seemed to be in a condition of growing well, but that he began a little to falter in his speech: in the evening, when it was least suspected, the Feaver being again inkindled, on a sudden he fell into a Lethargy, that he was scarce able to be awakned from sleep, and being pulled, scarce to know any body, or to speak plainly: altho so great a loss of Blood had gone before, the Pulse was yet quick, high, and vehement, also his Urine red: after deriving, and withdrawing remedies, had been used all that Night, this Youth seemed to be in a little better condition, so that in the morning, he continued a long time from sleep, but began to rove about his Eyes hither and thither, and to set himself up a little; yet without speaking, or knowledg of those that were about him: before noon, his Eyes being shut again, he wholly lost the use of every Animal faculty: he lay for three days, as it were Apoplectick, with an high and vehement Pulse, with a palpitation of the Heart, and a difficult and painful breathing; his Pulse at length growing lesser by degrees, he dyed the thirteenth day of the Feaver.

On the fifteenth of *February*, his Sister, somewhat lesser than he was, began to complain of a pain and torments in her Belly, a trembling in her hands, and a painful tension or stretching out of the Muscles of her Neck, with a Feaverish intemperance, and thirst: on the last day of *February*, she growing plainly into a Feaver, could not keep out of her Bed: moreover she was troubled with a wandring heat, now in her Face, now about her lower parts; also she became heavy and somnolent, and awaking from sleep, could not presently come to her self. On the first of *March* she was lightly Purged and with ease, with an expression of Rhubarb: her Urine was thick and red; also petechial red spots, (as in the rest) were conspicuous: we gave her after that, for four days, at several times, to wit, after the interval of every six hours space, ten drops of the spirit of Harts-Horn, in a Spoonful of Cordial Julep; the aforesaid symptoms afterwards leisurely remitted, and this sick child, tho slowly, recovered health without a manifest through Crisis.

About the same time her little Brother, younger than any of these, fell sick almost after the like manner; who, yet, a looseness arising Naturally of it self, for many days, voyding Cholerick and greenish stuff, was easily cured. Also in the same Family, many other Domesticks, and some strangers coming to help them, the evil being propagated by Contagion, fell sick of the same Disease: who notwithstanding, at length became well, tho with difficulty, and slowly, without any regular Crisis being made.

That this Feaver was malignant, plainly appears by the Contagion, Mortality, and appearances of spots, and many other signs; tho that infecting Contagion, whereby it spread from one to another, shewed it self slow, and of lesser Efficacy: because, between the sicknesses of each of them, many days, and oftentimes weeks hapned to be, that the infection of this tho acute Disease, and the dissemination on others, was scarcely finished in four months space, in the same House. The Feaver about the first beginning seemed gentle and mild, not very terrible as to burning; but the matter being heaped together, from the deflagration of the Blood, became presently untameable, hard to be exterminated, also enemical to the Brain and Nervous stock; wherefore in each of them, the beginning of the Disease, was to be known rather by the torpor and somnolency, than the fervor and heat; also, the Crisis, tho by several ways attempted, viz. by Sweat, Flux, Bleeding, did not happily succeed, but for most part, the Blood growing turgid with the critical motion, endeavoured to transfer the Feaverish matter, upon the dwellings of the Animal Spirits; yet it self notwithstanding, became not putrified by this means, but that about the standing of the Disease, both humors (to wit the Blood and Nervous Juice) being vitiated, by an impure mixture together, and grievously touched, caused the event of the Disease, to be either deadly, or extream dangerous.

C H A P. XV.

Of the Measles and Small-Pox.

IN the next place, we refer the Small-pox and Measles to the rank of pestilential and malignant Feavers, which indeed are mixt Distempers, consisting at once according, and contrary to our Nature. As to their Original, they have their seminary born with us: but as to the effect, they produce preternatural symptoms, and (as the Plague it self) poysonous; so that they constitute as it were a certain peculiar kind of Feavers, proper indeed to men, but after another manner, than Porphyrius has assigned; for it happens for every man only, and once to be distemper'd with the Small-pox or Measles: if perchance any one lives free their whole life, or another more often fall into these Distempers, they are rare and unusual events of Nature, which lessen not common observation; yea tis fully confirmed, to wit, that all, and only men are obnoxious to the Small-pox and Measles, and are wont to be rid of them at one sickness. Concerning the Small-pox, we will treat of them apart from the Measles, what the cause of them is, then what signs and symptoms they have, and lastly what things belong to the Crisis and Cure.

Concerning the Causes, we ought to consider in the first place, what is the secret leading Cause, to wit, which renders only and all mankind, and that once, obnoxious to this Disease. Secondly, we will inquire concerning the evident Causes, *viz.* by what and how many ways, this latent and occult disposition, is wont to be, now sooner now later, deduced into Act. Thirdly, it shall be declared, what is the conjunct cause, to wit, by what motion and alteration of the Blood, the figure of this Disease is produced.

1, As to the first, this disposition or Natural predisposition, which inclines human kind to this Disease, seems to be a certain evil or impurity of the Blood, conceived in the Womb, among the first Rudiments of Generation; almost all Authors, would have this ascribed to the Menstruous Blood: which Opinion seems not altogether improbable: because in a womans Womb, (otherways than in most other living Creatures) there is generated a certain Ferment, which being communicated to the mass of Blood, affords to it vigour and spirit, and then at set periods, procures a swelling up, and an excretion of the superfluous Blood; but at the time of Conception, when the *Menstrua* wholly cease, very much of this ferment is bestowed on the *Fetus* or Child; and its Particles, being Hæterogeneous to all the rest, as a certain extraneous thing, are confus'd with the mass of Blood and humors; with which being involved and separated one from another, lurk or ly hid a long while; yet afterwards, at some time, being moved or stirred up, by some evident cause, they ferment with the Blood, and induce to it an ebullition, and then a Coagulation; from whence very many symptoms of this Disease arise.

These fermentative seeds sometimes are few and gentle, and so involved with other little Bodies, as they do not easily appear, and are brought into act; sometimes they are more and stranger; so that on the least occasion they are ripened into this Disease; hence indeed some are taken sooner, with the Small-Pox in their tender years: others more slowly, and not till full or more ripe age: also some easily receive the contagion, but others converse often with the sick without danger. The sooner that any one hath this Disease, the more secure they are; wherefore children most often escape, old men, or such as are of years, are more in danger, *viz.* in children or young people, transpiration is more easie, also the habit of the Body more firm and healthful. But altho the venomous seeds of this Disease, for the most part are wont to be disperfed or blown away at once, and with one sickness; yet it sometimes happens, that a part of the infection being still left, the sick have fallen into this Disease twice or thrice.

2. The evident cause which stirs up these fermentative seeds, and most often brings them into act, may be said to be threefold, *viz.* The contagion received from some place: the disposition of the Air, and the immoderate perturbation of the Blood and Humors. It is most manifest by daily experience, that this Disease doth come upon others, and spread abroad by contagion; *viz.* from the infected Body, continually flow *Efflu-*

via, which being received by other Bodies, presently like poyson they ferment with the Blood, and suscite or awaken the lurking or sleeping seeds of the same Disease, Homogeneous with themselves, and dispose them into the figure or Idea of this Disease: neither is the infection only communicated by contact, but at a distance. They who live within the same house, or neighbouring to the sick, easily receive the infection; also it is cherished in Cloaths, and dissipated afar off, and transferred to more remote places. They who are of kin one to another, soonest infect each other: also they who are fearful, and extremely dread this Disease, more readily fall into it: For by fear, the Particles of the infection are conveyed inwardly from the superficies of the Body. At what time the contagion spreads, and that the Small-pox are Epidemical, all other Diseases almost degenerate into this. Secondly, a certain peculiar disposition of the Air, notably induces the Small-pox; hence most often it becomes Popular, and rages ordinarily through whole Regions, Cities and Villages; hence also it more often exists in the Spring and Autumn: because at that time especially diverse manners of little Bodies, and by that means tumultuating flow about in the Air, which we draw in with the vital Air, and so various effervescencies of the Blood and Humors, and Ideas of Diseases are raised up. Neither doth this Disease become only more frequent and Epidemical, for these Causes, but also it gets a manifold Nature, that sometimes the Small-pox are deadly, and as it were pestiferous, and sometimes they are more mild and benign; to wit, as they have contracted more or less of malignity from the Air; hence also sometimes black and livid Whelks or Pustils appear, and have much of the Nature of the Plague. Thirdly, sometimes, tho the tinder of contagion be absent, and that no malignant constitution of the Air had gone before, yet by reason of the Blood and Humors being immoderately disturbed, the Small-pox do arise: so I have known some to have fallen into this Disease, from a surfeit, or immoderate exercise, when none besides in the whole Country about, hath been sick of it, to wit, the seeds of this evil, lying hid, without any previous infection, being stirred up by a too great fervor of the Blood, and being associated, gathering together, easily defile, and infect the whole mass of the Blood, with their ferment.

3 So much for the secret leading, and evident causes, but as to the conjunct cause, *viz.* which is the formal reason of this Disease, or the manner of its being made, the business seems a little more intricate. It is commonly wont to be compared to Must growing hot, or Beer when it Purges in the Vat: For if you put to these Liquors, any thing of ferment: as their Particles are Heterogeneous, and of wonderful activity, presently they diffuse themselves through the whole substance of the Liquor, they agitate the more thick and impure Bodies, against which they are dashed, beat them asunder, and role about them, until a flowing being made, they drive the same from the intimate embrace or company of the Liquor, to the outmost superficies. After the like manner the Heterogeneous seeds of this Disease, are thought to ferment the Blood, and then by a certain eruption of Whelks or Pustles, like the flowing, purifies it. But indeed, if we should more strictly consider the business, there will appear here a great difference: because the infection of the Small-pox, is as it were a ferment, but corruptive, and compels the Blood to grow hot, not towards perfection, but depravation; for when the Particles of this venomous infection strike against the receiving subject, they presently raise up little Bodies like to themselves, and born with us, with which being associated, they pass through the whole mass of the Blood, and make it to grow highly turgid, and to boil up, and after some time growing fervent, to go into parts, and to be coagulated, *viz.* the dispersed seeds of the Poyson, dissolve the mixture of the Blood, presently profligate the more pure Spirits, then they joyn its more thick Particles to themselves, and by their adhesion, render them as it were congealed: The portions being so coagulated, together with the infolded seeds of the poyson, being left by the rest of the Blood, in its circuit, between the extremities of the Vessels, are affixed to the skin: by which means, if Nature being strong enough, doth cast forth the whole poyson, with the congealed Blood, the remaining mass of the Blood, altho made poorer, remains however in a condition to continue life and health: but if the Blood, being too excessively congealed, cannot be purified after this manner; or if portions of the Blood growing together with the poyson, do not fully break forth, or at last do stagnate within, they wholly corrupt the Liquor of the Blood, or else being affixed to the Viscera, and especially to the Heart, they destroy their constitution and strength.

Portions of the congealed Blood, with the poyson, begin to break forth about the fourth day, (now sooner now later :) because coagulation is not presently induced, but after some time, in which the venom unfolds it self, and ferments the Blood with its effervency: First, light portions of the infected Blood, and those but few in number, like to Flea-bites, are fixed in the skin: quickly after more appear, and those first broke forth, by the accession of new matter, and by the continual appulsion of the congealed Blood, increase and are elevated into a tumor: then these wheals at first red being by degrees increased, at length grow white; *viz.* the Blood being thrust forth of the Vessels with the poyson, by reason of the heat and stagnation, is changed into matter: about the seventh day after the eruption, the white tumors grow crusty, into a dry scab; for the more thin part of the matter being evaporated, the rest grows hard, which then having eaten, and broke off the Cuticula, or outward thin skin, falls away from the flesh or next skin.

When the infection of the Small-pox, is at once impressed on the Blood and Spirits, it very rarely can be blotted out, or dissipated by Medicines, or blood letting; but that its hidden disposition, will break forth into act; wherefore at first it diffuses it self by little and little, and inspires the mass of Blood, as it were with a ferment, hence an ebullition and growing hot are produced in the whole Body, the Vessels are distended, the Viscera provoked, the membranes pulled, until the seeds of the contagion, by fusing and coagulating the Blood, being at length involved with its congealed portions, are thrust forth of doors. The essence of this Disease will be better laid open, if that I shall recount the signs and symptoms, which are to be observed in its whole course, and shall add in order the reasons and causes of them, on which they depend: but they are those which either indicate the Disease being present, or that foretel its state and event.

As to the Diagnosis of this Disease, by which it may be known, whether any one at first falling sick, will have the Small-pox or not; at that time are to be considered, the force of the contagion, and the concurrence of the symptoms first appearing; for if by reason of the evil constitution of the Air, this Disease doth spread abroad every where, none then is taken with a Feaver, without the suspicion of the Small-pox, especially if they never had them before in their lives; but if this Disease be more rare, and without fear of contagion, yet its unlooked for assault quickly betrays it self, by these sort of signs and symptoms.

1. There is a wandering and uncertain Feaver, sometimes strong, sometimes more remiss, observing no reason of increase, or growing continually hot, so that the sick are now highly hot, by and by without any evident cause, they are without a Feaver; the cause of which is, for that the fermentative seeds are not agitated by an equal motion, but like fire half choaked, now increases more, and now are almost quelled, and ready to expire; until the burning spreading more largely, the flame every where breaks forth.

2. A pain in the Head, and Loins, is so peculiar a sign in this Disease, that it almost alone, in a continual Feaver, signifies the approach of the small-pox: the reason of which is commonly imputed, to the greater Vessels being very much distended, by the effervency of the Blood: but indeed it appears not, wherefore the same trouble is not caused equally in other parts, by reason of the like distention of the Vessels, and wherefore in the small-pox, more than in a burning Feaver, or in other Feavers, where the Blood grows more hot, these kind of pains should increase; yea, it may be observed, that great pains, now in the Head, now in the Loins, do urge, when the Blood but little swelling up, the Vessels are not amplified, *viz.* in the beginning of the Disease, when the Feaverish distemper is not yet conspicuous, whilst the sick as yet goe abroad, and are well in their stomach, upon the first coming on of the small-pox, they betray themselves by these kind of pains. Wherefore, the cause of these kind of dolorific pains, seems rather to subsist in the nervous stock, *viz.* in the Brain, and spinal marrow, and that by reason of the membranes, and nervous parts being pulled or hauled, by the particles of the Poyson, these pains do arise. For it is most likely, that the innate seeds of the small-pox, are chiefly hidden in the Spermatick parts, and that first of all, the Contagion lays hold on, for the most part, the animal Spirits; hence, the first effervency is stirred up in the juice, wherewith the Brain, and nervous parts, but especially the Spinal marrow are watered, and from thence the evil is Communicated to the mass of Blood; wherefore, this Disease beginning, the Head and Loins are tormented with cruel pain; afterwards, the venom being translated into the Blood, the Feaverish effervescency is stirred up in the whole.

3. Great

3. Great anxiety, and inquietness, and sometimes a swooning, infest the sick, viz. by reason of the perturbed motion of the Blood, as also its equal mixture, beginning to be solved, by the Poysonous ferment, the Blood from thence being apt to stagnate in the Heart, and to be hindred in its Circuit, causes these affections to be thus excited.

4. Cruel Vomiting, also when the Ventricle is free from an impure ballast of humors, very often accompanies this Disease; the reason of which is, because the fermentative seeds, being stirred up into motion, by the little Arteries gaping into the Coates of the Ventricle, are deposed by every appulse of the Blood, and raise up Vomiting, as if the particles of stibium had been swallowed; but afterwards, as soon as sweating being procured, the Poyson is driven forth outwardly, this Symptom ceases, and the sick are well in their stomach, without any purging forth of the noxious matter.

5. With these may be ranked, the Symptoms which shew themselves, according to the various habitudes of the Body, after a diverse manner, as heavy sleepiness, terrors in sleep, deliriums, tremblings, and convulsions, sneezing, heat, redness, a sense of pricking over the whole Body, involuntary tears, a sparkling and itching of the eyes, a tumor or swelling up of the face, a vehemency of Symptoms from the beginning, that the Disease seems presently to have attained its strength: the reason of all which, may easily be elucidated, if what hath been already said, concerning the Symptoms of Fevers, be observed; with respect to the diverse tempers of the sick, their habit, and age, as also the condition of the year.

2. As to the Prognosis of this Disease, by the Symptomick signs, it is indicated to be either salutary, or mortal, or of a doubtful Event.

1. The business promises well, when this Disease has benign circumstances; to wit; when it happens in a good constitution of the Air and Year, at what time the small-pox are less malignant and pestilential; as in the year 1654, at *Oxford*, about Autumn, the small-pox spread abundantly, yet very many escaped with them: but before, in the year 1649. this Disease was more rare, yet most dyed of it. Also, there is less danger, if it should happen in the age of Childhood, or Infancy, or in a sanguine temper, and good habit of Body, or in a Family, to whose Ancestors, the small-pox have not proved mortal: Besides, if in the whole course of the Disease, the Symptoms prove laudable, if in the first assault, there be a gentle Fever, without cruel Vomiting, Swooning, Delirium, or other horrid Distempers; if the Fever about the fourth day be allayed, with the Symptoms chiefly urging, and then some little red spots begin to appear: if on the second day, of the coming forth of those little red spots, they become more conspicuous, which afterwards grow together by degrees into little Pimples, and are ripened into matter; if about the tenth day, or thereabouts, after the eruption, the white tumors begin to scab, and by little and little from thence to fall off: if after their first coming forth, the small-pox are soft, distinct, few, round, sharp pointed, lying only towards the skin, and not in the inward parts, you may be confident the sick will do very well, and is in a good condition.

2. The appearances, which in the small-pox, signifie the business to be suspected, and full of danger are of this sort: if there be a malignant constitution of the Air that this Disease becomes Pestilential, and that many die of it: if men of more ripe years, or middle age, be taken with it; if it happens in a cold and melancholick temper, or in an impure or evil humoured Body, where the Blood is not rightly circulated, nor transpiration truly performed; or if the Hypochondria, or Precordia are obstructed, some of the Viscera infirm, or troubled with an Ulcer, or if the habit of the Body be too fat, the small-pox happen not without great danger of life; nor is it less to be feared, when presently after the beginning, a great Fever, cruel Vomiting, Swooning, a dejection of strength, Phrensie or Delirium, come upon them, and that these desist not, upon the full coming forth of the small-pox, for these signifie a too great perturbation in the Blood and humours; also, a confusion and contumacy of the morbidick matter, which can neither be subdued, nor easily separated from the mass of Blood, or equally extruded from it: if there be an anxiety, and great inquietness, with an inordinate boiling up, and growing hot of the Blood; also a great thirst, a difficulty of breathing, also a flux of the Belly, or Dysentery, they shew that sweating is hindred, and that the malignant humours, restagnate towards the inward parts: The small-pox breaking forth slowly, argue the crudity, and untameableness of the matter, and the impotency of Nature, and tis much more a sign, if they come forth double, and continued, in too excessive a quantity, and confusion, and also if there

there be a disordered expulsion, and irregular, of that matter, when not in certain issues, but every where undistinguishable. The pox being hard, signifie the incoction of the same matter, being depressed, a weak expulsion; and they are the worse, if in the midst of them appear black spots; or if purple spots familiar to the Feaver, or the Plague, are sprinkled among the pox, they indicate a great malignity, and putrefaction of the Blood, such as is wont to be found in the Pestilence. Lastly, the pox being black, livid, or green, are of an evil omen, because, besides the coagulations of the Blood, they argue its deadlinesses, and corruptions, as in a Gangreen, or pestilent Plague sore; if when the small-pox being come forth, they presently grow dry, and the swelling of the parts remit, it shews a going back of the malignant matter, or of the congealed Blood, with the Poyson, and a restagnation of it to the inward parts; from whence, unless a more free Diaphoresis or sweating be excited, that it may be thrust forth of doors again, death for the most part quickly follows: For from hence, the Blood being more coagulated, enters into putrefaction, also it is apt to be hindred in its motion, and to stagnate in the heart, and Vessels. If after the coming forth of the small-pox, a flux of the Belly, or a Bleeding at nose, comes upon them, it is an evil sign, because, by this means, the Venom driven outwardly, is again called back inwardly; but sometimes I have observed these Symptoms to have hapned, with great ease to the sick, *viz.* Nature being before oppressed, and burthened; after this manner, part of the burthen being as it were detracted, she was eased; wherefore, she buckled her self to the work of sweating, and more readily expedited the expulsion of the noxious matter.

As to the Curative part, since the stadium or course of this Disease, hath three seasons, as it were so many measures, distinct one from another, the Curative intentions ought to be accommodated to each of these; wherefore the Curative method concerning the small-pox, teacheth first, what is to be done so long as the Blood boyles up, and grows hot inwardly, with the motion of the fermentative matter, and before the small-pox appear, which period for the most part is finished, in four or five days.

Secondly, what means or manner of Dyet and Physick is to be instituted, after the coming forth of the small-pox, until the state or standing of the Disease, *viz.* whilst the wheles or pox come to the height, and being fully suppurated or ripened, begin to dry. Thirdly and lastly, what we must observe in the declining of the Disease, even whilst the small-pox growing dry, fall off.

1. As to the first, let the intention be, that we may carry away every impediment of Nature, whereby the Blood being infected by the ferment of the Small-pox, and apt to be coagulated, may yet retain an equal motion in the Heart, and without stagnation in the Vessels, and growing hot, may expel forth of doors the congealed portions with the Poyson; in the mean time, there must be a caution, least the work of fermentation or growing hot be any ways hindred, or too much provoked; for by this, the mass of the Blood is agitated into congealed portions, more than it ought to be; by that other, it is restrained too much, in its motion, nor are the invenomed Particles sent forth of doors, with the congealed Blood; Nature in the work of secretion and expulsion, is wont to be hindred, by too great an heap of excrements in the Viscera, or by the abundance of Blood in the Vessels; wherefore, upon the first assault of the Disease, care must be taken, that if need be, an evacuation by Vomit or Stool, be timely procured; but only more mild Purges, and gentle, are to be used, which do not too much provoke, or disturb the Humors: wherefore, at this time, Purges, Emetics, or Clysters, now these, now those, take place; also the letting of Blood, if there be a fulness, is performed with good success.

During this growing hot of the Blood, dyet ought to be instituted slender and moderately cooling, *viz.* Barly-Broth, or Grewel of Oatmeal, Posset-drink, Small Beer or the like: Flesh, and Flesh Broths are to be avoided, whereby the Blood, by reason of the too great plenty of Sulphureous Food, may be inkindled more than it ought; also all cold, and sharp or acid things are hurtful: for these congeal the Blood more, and contract the little mouths of the Vessels, by their attriction or binding Nature, that the Small-pox come forth less freely; also hot things, and Cordials are cautiously to be administred, for by these the Blood and Humors are too much agitated, and driven into confusion.

2. When the Small-pox begin to appear, there are three things, which by a constant Rule we prescribe to be performed, to every sick person; to wit, that a soft and gentle Sweat be still continued in the Blood; also, that the Throat and Eyes may be preserved, from a too great eruption of the Small-pox. That the Blood lightly growing hot may emit the Small-pox, decoctions of Figs, Marigold flowers, and shavings

of Harts-Horn in Posset-drink, are commonly prescribed, and the use of them is general for a long time, almost with all people; for the same intention, we are wont sometimes in a day, to give them moderate Cordials; but the more hot and strong are carefully to be shunned; Purging and Blood letting here are most wickedly enterprised, and these, tho necessity compelled, Physicians dare not meddle with for fear of blame: For to defend the Throat and Guttural parts, we put on the outer skin, a defence of Saffron dipped in Breast Milk, and sowed in a Rag; for these, by opening the pores, draw away the venom outwardly, from the most inward part of the Throat; also for this end, we administer Gargarisms, and things to wash the mouth, which by their restriction, restrain the coming forth of the Small-pox withing: we defend the Eyes, with peculiar Medicines, of Rose-water, and Breast Milk, with Saffron, and such like, frequently iterated, from the incursion of the Small-pox: Besides these, sometimes certain most horrid symptoms do trouble, which must be timely helped with convenient Remedies; sometimes there are present, Watchings, Phrensie, Bleeding at Nose, Vomiting, Loosness, and a falling back of the Small-pox: for these and divers others, as occasion arises, a prudent Physician knows how to provide; in which however there is need of great caution, lest whilst we take care of the smaller matters, the great work of Nature should be disturbed by a too great molestation of Medicines. For in all this time there is one, and a continued Crisis: wherefore nothing is to be meddled with rashly. There is required the most care and circumspection of the Physician and Nurses, or those that administer to the sick, when this Disease is at its height or standing, *viz.* least that when the Small-pox be fully come forth, and brought to their greatest height, transpiration should be hindered; for then the sick are in danger of renewing the Fever, and of the restagnation of the Malignant matter within, whilst we study to prevent the one, we for the most part bring on the other.

3. When the Disease shall be in its declination, and the Small-pox begin to wither and Scab, the business for the most part is out of danger, nor is there much need of a Physician: let the sick, tho he grow very hungry, content himself still with a slender dyet, and without flesh: if the Scabs fall off slowly, we are wont to ripen them with Lineaments, and peculiar Medicines, to make them fall, and care should be taken that they leave not behind them too great pits: after the sick having the Scabs every where fallen off, and are able to rise and walk about the Chamber, the filthy Excrementitious matter in the Bowels, is to be carried away, by two or three times Purging, and then they may be permitted to use a more plentiful and stronger dyet.

The Measles are so much akin to the Small-pox, that with most Authors, they have not deserved to be handled apart from them, but that either distemper have been treated of together, after the like manner and method. The essence and cure differ at least accidentally, or as they are greater or lesser; because in the Measles the whealks rise not up to so great a bulk, neither are they suppuritated; wherefore the sickness is sooner ended and with less danger. This distemper is wont mostly to spread upon children, more rarely among those of years, or old men, also those who first have had the Small-pox, are not afterwards so obnoxious to the Measles, but in most things, either distemper are of kin, *viz.* the evil being contracted in the Womb, disposes men only, and all men once, to the Measles; the malignant constitution of the Air, and sometimes a surfeit, and most often the contagion, are wont to bring the hidden disposition into act: there are present marks of malignity, and the sickness oftentimes becomes Epidemical, and with mortality and contagion.

That I may briefly contract the sum of the matter: it seems that the Measles are a certain lighter flowring, of an extraneous ferment, contracted from the Womb; by which, some Particles being stirred up into motion, make the Blood lightly to grow hot, and to be a little coagulated: wherefore the marks from thence spread abroad, are dissipated without any breaking of the Cuticula, or outward skin, by evaporation only: but the Small-pox are a more full and strong agitation, according to all the Particles of the same ferment, which causing a greater ebullition and coagulation of the Blood, produces far more full whealks, and greater in bulk, and not to be dissolved, but by suppuration, or growing into matter: when the Small-pox proceed, they are not only exempt from the same disease any more, but also from the Measles, because they consume only some of the Particles of the ferment, leave still a disposition to the Small-pox; wherefore old men, or those of years, are not so readily infected with the Measles, because they are either freed from the contagion, by having before had the Small-pox, or else the infection of this more light Disease, is easily resisted by their more strong Spirits.

It were easie to illustrate the afore-recited Doctrine, concerning the Small Pox, with Histories and Observations of the sick, becaule there is no Disease besides can supply with a greater plenty of Examples, or variety of Accidents: but of the great number of this kind, I shall only propose in this place a few Cases, and those remarkable for some irregularities.

It is a usual thing to handle all that are sick of the Small Pox, with a like, or wholly the same method of Curing, and manner of Dyet; wherefore, a Physician is rarely sent for to the common sort, but the business is wholly committed to some women, professing themselves skilful in this Disease: and these are wont to boyl in their broths, and all the supplings of the sick, Marigold Flowers, shaving of Harts-horn, and sometimes Figs; also every night to administer a Bolus of Diascordium: and they who grow not well by this kind of Government, tho not neglected, yet are affirmed to be incurable, by reason of the cruelty of the Disease. But truly this kind of practice is not convenient for all alike, nor to be administred to every one indifferently, as these two following Histories will make manifest.

A Young Man, about 20 years of Age, of a slender body, and more hot tempera-
ture, began to be feaverish in the beginning of the Spring, at first cruel Vomitings, an
oppression of the heart, and frequent changes of heat and shivering, a pain in his Loyns,
a disturbance of his fancy and wakings infested him: on the third day, the Small
Pox appearing, those symptoms remitted, but still the Feaver, with heat and thirst
continued. Not only the accustomed Decoctions in this Disease, but also a most ele-
gant Julep, of a most grateful taste, were so nauseous and troublesome to him, that
he would not so much as taste the same, but with a great deal of trouble: as often as
he took going to sleep, Diascordium, or any other more temperate Cordial, for the
continuing his sweat, tho in a very little quantity, the night following he was with-
out sleep, and in great disquiet; and then in the beginning of the morning a bleeding
followed, by which means, indeed, the Small Pox being full come forth, the Life of
the sick was in great danger, by reason of this occasion happening once or twice;
wherefore, when I had found by observation, his blood apt to grow immoderately
hot, by so light a provocation, I instituted this method as occasion served. All Me-
dicines being let alone, he took for the quenching his thirst small beer, and simple Al-
mond Drink, at his pleasure: for his food, because he vomited back all Oatmeal
Grewel, or Barly Broth, he eat only apples roasted tender, and drest with sugar and
rose water, often in a day. Nature being contented with this slender ordering, and
being seen to be disturbed with any other thing, performed happily its work, that the
sick person grew well, without any grievous symptom afterwards, the Small Pox
from thence ripening, and then of their own accord falling off.

In the middle of the Autumn, of the former Year, a Gentile Young Man, being
indued with a sharp Blood, and obnoxious to a frequent bleeding at Nose, fell sick
of the Small Pox; his Blood of its own accord grew immoderately hot, that the
whealks very quickly broke forth over all his Body: Posset Drink, with Marigold
Flowers, and other usual things boyled in it, also Juleps, or any Cordials, tho tem-
perate, and gently provoking sweat, most certainly stirr'd up a Flux of Blood in this
Person; wherefore I ordered the like manner of Dyet, as in the sick Person before
cited; by which he found himself better; however, in the very state or standing of
the Disease, (when the Small Pox being fully come forth, by reason of a more diffi-
cult transpiration, the Feaver is wont to be somewhat renewed in all) this sick Man
fell into a most plentiful bleeding; that after a large profusion of Blood, the Small Pox
began to flagg or fall: After that Remedies, very many, were tryed in vain, for the
staying of the Blood, at length a little Bag being hung about his Neck (in which was a
Toad dried in the Sun, and bruised) he first, and immediately perceived ease; tho the
bleeding was by this means stayed, and not any more returning, (whilst he constant-
ly wore this peculiar Medicine in his Bosom) our sick Man still using a most thin and
cooling Dyet, grew quite well; that indeed from hence it may appear, that altho
the Blood in this Distemper, is apt to be greatly coagulated, yet so long as the Vital
Spirits, being strong and robust, are able sufficiently to execute their government,
they indeavouring by their proper strength or forces, do best of all separate and thrust
forth the congealed portions of the Blood, as it were by a certain skilful separation;
and this work is most of all hindred, when the same spirits are too much irritated by
Cordials, or more hot food, and agitated into confusion: But in the Plague it hap-
pens otherwise, because in this, if any delay be granted, the Spirits themselves are
presently

presently profligated by the venom; wherefore, here they must fight close and quick, when in the Small Pox, the Physician does his business better by delay.

Concerning letting of Blood, at the instant breaking out of the Small Pox, it is very dubious: formerly, among our Countrymen, this was esteemed a wicked business, neither were they wont to admit of Phlebotomy under any pretext of necessity: but of late, experience having taught us, in some cases, it is found, that to let Blood hath been wholly profitable and necessary; which evacuation however, if it should be administered indifferently in every constitution, or when this need should be, it should be performed in too large a quantity, by that means oftentimes very great damage arises.

Some years before, I visited a young Gentlewoman, of a florid countenance, and more hot temperature, growing into a Fever, after the fourth month of her being with Child: she was troubled with a cruel vomiting, a most cruel pain of the Loyns, besides with most strong heat and thirst: her pulse was swift, with a strong and vehement vibration or beating: altho the Small Pox had never been in that place, yet these symptoms gave no light suspicion of this Disease; however, its great effervescency indicated that Blood should be taken away; wherefore I took away about six ounces presently, upon which the heat remitted somewhat, yet the vomiting, with a cruel pain in the Loyns, remained still: At the hour of sleep I gave her a Cordial Bolus, with half a grain of our Laudanum, by which means quiet sleep followed, with a pleasant sweat, and an allaying of all the symptoms: the next morning the Small Pox came forth, with which, altho the sick Gentlewoman was greatly disordered, yet she grew well without any dangerous sickness, or fear of miscarrying, and went out her full time.

The last Autumn, a strong Man, of an active and robust constitution of body, yet of a pale countenance, and more cold temper, fell into a Fever: on the second day he was tormented with heat and thirst, and a most cruel pain in his Loyns: when I had prescribed Blood to be taken in a small quantity, the unskilful Chirurgeon, who was sent for, took from him almost half a pound; a little after, the sick man began to be all over in a cold sweat, on a sudden to loose all strength, to be troubled with a shivering, a weak Pulse and unequal, and frequent swooning: At this time being sent for, I gave him a temperate Cordial, to be taken frequently. His Spirits and Pulse being thereby restored, the Fever was renewed, which afterwards, for some days, yea, weeks, exercised the sick man, after a very irregular manner; for he was wont for three or four days, to grow very hot, also to be infested with thirst, watchings, headach, and other symptoms, then to be troubled all over with a copious and critical sweat, by which indeed for half a days space he found himself better: But from thence, the Fever still growing worse, heaped together again new matter, till it was dispersed by another Crisis, and then another. After that he had been thus feverish, for at least twenty days irregularly, at length the Small Pox began to come forth, in several parts of his Body, here and there, and then the Fever wholly remitted; yet within few days, by reason of some errors committed in his Dyet, very many of the whealks began to fall down again, few of them only being brought to maturity: However, instead of the subsiding Small Pocks, a mighty Bubo grew up behind his right Ear; from which, being soon ripened, and broke, a great plenty of matter flowed forth for many days, and so at length the corruptions of the Blood, unable otherways to be dissipated, were carried forth by degrees, and the sick Person recovered perfect Health.

C H A P. XVI.

Of Feavers of Child-bearing Women.

Vulgar Experience abundantly testifies, that the Feavers of Women lying in are very dangerous, beyond the disposition of other common Feavers: also that the same differ very much, as to their essence, from both a simple and putrid Synochus, plainly appears from their signs and symptoms rightly weigh'd: wherefore, I believe it not to be from the matter, to handle after malignant Feavers, the acute Diseases of Women lying in, being exceeding neer of kin to those, for their mortality or perniciousness. Yet, before I shall enter upon the unfolding these Diseases, it behoves us to consider their subjects, *viz.* the Bodies of Women in Child-bed, after what manner they are predisposed, and by what provision they are made obnoxious to these kind of sicknesses.

Concerning this, the first thing that offers itself, is, that the Flux of the menstruous Blood, is wholly convenient to be suffered by human kind, and at this time for Women, concerning whose nature and original we shall not inquire in this place; but it shall suffice to note, that in them, the particles of the Blood, to be periodically thrust forth, are very Fermentative; which, if retained in the Body, beyond the wonted manner of Nature, are very often the cause of many Diseases: unless only when a Woman conceives with Child. For all the time of her being big Bellied, the monthly Flowers are stopped without any incommodiousness; and in the mean time, milk, or the alible juice, is disposed in great plenty, about the parts of the Womb, for the nourishment of the Child: but after the Birth, this daily suppression of the monthly Flowers, is recompensed by a copious flowing forth of the Lochia, or what comes away after the Birth; and the milk within three days having wholly left the Womb, springs forth plentifully into the Breasts: at which time, Women lying in, are wont to be troubled with a small Fever. If that the milk be driven away from the Breasts, it re stagnates again towards the Womb, and is thrust forth, together with the Lochia, under the form of a whitish humour. In the mean time, the Womb, after the Birth, becomes subject to various distempers; for oftentimes, its tone is hurt, the unity is dissolved, and many other accidents are induced, which render Women lying in subject to danger: wherefore, that their acute Diseases may be rightly unfolded, it is convenient, for to consider chiefly these three things, *viz.* first, the nourishment of the Child, or the Generation of Milk, both in the Womb, and in the Dugs, and the metastasis or translation of it from one to another. Secondly, the purging of the Mothers Blood, or the profluvium of the Lochia, after a long suppression of the Menstrua. Thirdly, the condition of the Womb after the Birth, and its influence on other parts of the Body. And these being premised, we will speak of the Feavers of Women lying in, *viz.* both the milkie, and the putrid, called, and that deservedly, malignant, by reason of its deadliness.

First the Milk, and nourishing humour, being heaped up in the parts of the Womb, for the nourishment of the Child, are of a like nature, tho somewhat different in consistency. Milk is indeed more thick, because it ought to be received in at the mouth, and to be kept in the Ventricle, and afterwards it more thin portion to be conveyed to the mass of Blood. The other alible Juice is more thin, and like the water of distilled Milk, because 'tis immediately poured into the Blood of the Embryo, thro' the umbilick Vessels, without any previous digestion. Either Juice is supposed to come from the Chyle fresh made in the mothers stomach; what is reposed, or laid up in the Breast, is more thick and white, by reason of the more thin or open strainer, and coction in the greater Glandulas; on the contrary, it happens in the Womb otherwise, where the Glandulas are smaller, and the Straining more close. But there is a great disagreement among Authors, concerning the passages, by which this humor is carried, both in the Breasts, and into the Cake of the Womb. Some contend, that Milk only is begotten of the Blood, more plentifully cocted in the Glandulas, which yet, by reason of the immense dispense of Milk, which consists not with the Blood, this seems not probable. Others affirm, that the Chyle, or Milkie humor,

is immediately conveyed from the Viscera of Concoction, thorow occult passages, without any alteration, into either receptacles. But in the mean time, while these passages lie open, it seems indeed to me more likely, that from the meat taken into the Mothers Stomach, a portion of the Chyle thence made, is presently supped up into the Veins, which having obtained the vehicle of the Blood, before it be assimilated by it, is laid up in the Glandulas, destinated here and there for the receiving of it, being carried by the Arteries, and lastly separated from the mass of Blood; for as it appears, that drink being plentifully taken, presently passes thorow the whole mass of Blood, and is rendered by Urine like water: and as old Ulcers, by means of the Blood coming between, prey upon the nutritious humor, from the whole Body, and pour it forth under the shape of a putrified matter, Why may not the alible Juice in like manner, being strained by the Collander of the Glandulas, before it has indued the colour of Blood, go into a Milkie humour? This indeed seems more probable, because, whilst the Milk is carried from the Womb into the Breasts, and on the contrary, passing thorow the mass of Blood, it is wont to stir up a perturbation thorow the whole, with a feaverish intemperance; besides, in the first days, after the Birth, when the Glandulas do less rightly perform the office of secretion: Beasts, who have not the Lochia, give a bloody Milk, which is drawn forth of their Udders, that is, mixt with Blood, by reason of the plenty of it flowing forth together.

Secondly, As to what belongs to the Menstrua being suppressed, in the time of being with Child, and the Lochia plentifully coming away, after being Delivered, we say that after the Conception of the Child, the Menstrua ought to be suppressed by Divine Designation, for that the flowing of them often causes abortion; then, because the Vessels are filled by a continual stilling forth of the alible juice into the parts of the Womb, the mass of the Blood doth not arise into swellings up, to be allayed by the menstruous Flux. For the same reason, Women for the most part, have not their courses so long as they give suck. Perhaps in some, indued with a more hot Blood, the monthly courses flow, both whilst they are Big-bellied, and in the time of their giving suck, but that more rarely, and is wont not to happen without trouble; yet in the mean time, the Menstrua being suppressed, during the time of being with Child, because much less of the nutritious humor is expended at that time for Milk, they much more deprave the Blood, than the same being restrained at the time of suckling the Child, are wont to do: yea, from them being long suppressed, in the former condition, an, as it were, envenomed taint is impressed on the mass of Blood, which, unless it be purged forth by the daily Flux of the Lochia, presently after being brought to Bed, produces grievous, and almost malignant Distempers. Wherefore that I may give my opinion of the flowing of the Lochia, I say, that this bleeding proceeds immediately from the Vessels being broken, by which the after-Birth did stick to the Womb, and that by this way, the excrementitious Blood and humors, being partly heaped up about the Womb during the time of being with Child, and partly flowing from the whole mass of the Blood, are evacuated, viz. whilst the Womb at first intumefied in its bulk, falls down presently after the Birth, and is contracted into a lesser space, the Blood is plentifully pressed forth, from the Vessels opening into it. But besides, forasmuch as during the suppression of the courses, the bloody mass is imbued with very fermentative Particles, as soon as after the Birth, the mouths of the Vessels are opened, forthwith, as it were at the instant of a more large Flux of monthly courses, the whole Blood grows hot (even as Must or new Wine upon the opening the Bottle) and endeavours to purge forth the highly fermentative particles, out of its bosom, by the going away of the Lochia, as it were the flowing: And therefore, besides the Blood, which in the first days, oftentimes flows pure, by reason of the fresh opening of the Vessels, afterwards is sifted forth matter very much discoloured, viz. livid and green, and this very stinking. This kind of Flux is wont to continue, at least for 14 days, yea, in some for a month; and if that by reason of any error, it be stopped before the mass of Blood be thoroughly purified, by such flowing, presently a Feaver, very dangerous, with horrid provisions of symptoms, is wont to be induced: of which we shall speak anon in its proper place.

The third consideration, previous to the Doctrine of Feavers, belonging to Women in Child-bed, is chiefly about the Womb it self; to wit, how it is affected after Child-bearing, and what influence it has on other parts of the Body. As to the first, there are chiefly two accidents, upon which the acute Diseases of Women in Child-bed very much depend, viz. First, The falling down of the Womb, or the reduction

duction of it, from the bulk of ingravidation, to its natural size and magnitude: Secondly, the solution of the unity, within its cavity, by reason of the breaking of the connexion, or tying to the cake of it, or after-Birth. When the Child, with what wraps it about, is put forth, presently the sides of the Womb it self, before very much amplified or enlarged, do mutually close, and by the help of the Fibres, leisurely contract themselves into a narrower space; by reason of this kind of contraction, the Blood and Corruptions, or matter, are plentifully pressed forth, from the Vessels and Pores of the Womb, and are thrust forth with the Lochia. But sometimes it happens; by reason of some preternatural things contained in the Womb, as part of the secundine or after Birth, a Mole or piece of Flesh, clodders of Blood, &c. also, if there happen after a painful Birth, a Contusion or great Dilaceration, that the Womb cannot rightly draw it self together, but by an inverse motion of the Fibres, ascends upwards, and is lifted up into a bulk; also the membranes being affected with a Convulsion, it self is still tormented with torments, as if it were yet in Travel; which kind of Distempers, if they long continue, by reason of the Orifice of the Womb being tied together, with the Convulsive motion, the Lochia are oftentimes stopped also: from hence grievous symptoms follow, and very often the Fever is either first excited, or it happens, being for some other cause induced, to be rendered far more dangerous. Secondly, as to the solution of the unity, from the cake of the Womb being broken, it comes to pass, that the Birth, either at its just time, or precipitous, being too much hastened; then the secundine is cast forth, either whole, or being torn, or pull'd away, part of it being left behind, it is cut off as it were in half. If the Child be born at its just time, and the Birth, with what inwraps it, comes away from the cavity of the Womb, as ripe fruit from a Tree, whole, and without violence, the mouths of the Vessels are somewhat unlocked, and the Lochia moderately flow; but from hence no grievous symptom is to be feared: but if the Child, not being yet ripe for the Birth, is pulled away, or breaks forth as it were by force, although the Cake, with the membrane is pulled away whole, yet the Vessels being torn, a greater hemorrhage or bleeding, and at length an Ulcerous disposition follows, the little mouths of the Vessels spewing forth a stinking matter. If that part, or the whole secundine sticks to the sides of the Womb, after the Birth, it there putrifies, and sends forth very stinking matter or corruption, and stirs up wicked distempers: oftentimes the Orifice of the Womb is shut up, and retains within gobbets of clodder'd Blood, little pieces of Membranes, or Flesh, which putrifying, by reason of the heat, impoison the Blood and humors, flowing together to that place, by Circulation, from the whole body; also, by a troublesome itching or provocation, they stir up the parts of the Womb, being so very sensible, into Convulsions.

When therefore hurt is brought to the Womb, from Child-bearing, after the aforesaid ways, the same is quickly communicated to other parts, not without trouble to the whole body; which thing indeed is wont to be done by a double means. For first, this happens, because the Lochia being hindered from being thrust forth, presently re stagnate or flow back upon the mass of Blood, and infect it as it were with a virulent taint: moreover, from the contents putrifying in the Womb, either the substance it self of the matter, or the Particles coming away from the cadaverous substance, are mingled with the Blood, and nervous juice, passing thorow that place, and quickly infect their whole liquors. Secondly, hysterical Distempers, are more largely extended, by reason of the notable consent, which happens between the Womb and the Brain, with the Fibres and Membranes of the whole body, by the means of the nervous passage: for when the extremities of the Nerves, planted about the parts of the Womb, are driven into Cramps and Convulsive motions, by reason of the presence of some hurtful humor, the Convulsions there received, presently creep more largely upwards, by the indeavours and circumduction of the Nerves, towards the Brain; and so it happens, to the Viscera to be successively inflated, and cruelly haled together, and the Brain it self at length to be pierced, and its functions to be as it were overwhelmed: hence, from the convulsive motions, arising about the Womb, an inflation of the Belly, and hypochondria, a rumbling, vomiting, sobbing, and streightness of the Præcordia, difficult breathing, a sense of choaking, and oftentimes a stupor, and want of speech, or at least some of these are excited: nor does the Tragedy so easily leave, but that also the Brain being hurt, by the continuance of the distemper, by that means, the evil is retorted upon other parts, that oftentimes the whole nervous stock is compelled into irregularities of motions; For
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what commonly is said to be done by vapours, and the distemper, called the ascent of vapours, creeping from the nether parts, to the upper, is nothing else than the parts of the Membranes, and nervous passages, being successively driven into Convulsions. Further, in these sort of distempers, the hurt action doth not always begin, or is at first perceived, in that region or place where the hurt is inflicted, neither do the passions which are called hysterical, proceed only from the Womb; for sometimes, the trouble is immediately brought from the Brain, or the Convulsions and Contractions begin in the extreme parts, and sometimes the extremities of the Nerves, somewhere in the Viscera, as the Stomach, Spleen, Reins, no less than the Womb, are halcd; in which, irregularities being arisen, they are continued into the neighbouring part, and from thence to the Brain: From whence again, the Convulsions are reflected to other parts, and not seldom thorow the whole Body. Just so the business in Child-bearing Women, and with others in Feavers, as I have often observed; to wit, some by reason of their Womb being evilly affected, but others by reason of a Feaverish matter fixed in the Brain, by a critical metastasis or translation, fall into passions like to the hysterical. And these things being rightly propensed, concerning the prævious provision, in the Feavers of Women in Child-bed, there is not any thing that we should stick at in the entrance more, so that we take notice that the bodies of Women lying in, (especially those who are feeble, and of a more tender constitution) are debilitated, chiefly after a difficult and hard Labour; so that, by reason of this occasion only, they easily conceive feaverish intemperatures, and being brought in by this or any other means, they are hardly able to bear them. We will next speak of the Feavers themselves, with which Women Lying in are wont to be sick, of which Distempers there are commonly recounted as it were three kinds, viz. the Milkie Feaver, the Putrid, the Symptomatic, or of that manner by a certain borrowed symptom, but is chiefly marked with the Pleurisie, Squinancy or the Small-Pox: of which we will discourse in order.

The Milkie Feaver.

WE have already said, that as yet it was uncertain of what matter Milk was immediately made, and by what passages it is carried into the Breasts, moreover when this part appears not at all to anatomical inspection, I am of the opinion, that the Milkie Chyme, being made out of aliments in the Bowels, and from thence confused to the Blood for nourishing juice, is presently again, for the most part of it, separated from its mass by the help of the Glandulas in the Womb, or in the Breasts, that it might supply the Child with nutriment, either in the Mothers Belly, or in her bosom by the Breasts. In the time of going with Child, altho the greatest part of this is derived to the Womb, yet in the last months, a little quantity of it is laid up in the Breasts; but about the third or fourth day, after being brought to bed, the Milk is more plentifully carried into the Breasts, and as it were with a certain force, that it quickly fills them to a stretching them forth, and begins to be troublesome. At this time, Women lying in (tho not all, yet most) are wont to be troubled with a feaverish intemperature, with thirst, heat, and an inquietude of the whole Body, they complain of a pain very troublesome in the Back and Shoulders, of a fullness and burning of the Breasts: and unless the Milk be diligently drawn forth, it being too much congested or heaped up, oftentimes brings forth an inflammation, with an Imposthume following of it in the Breasts. This Feaver, whilst the Lochia are in good order, hardly lasts three days, but that about that space it is wont to be allayed, a plentiful sweating arising of its own accord: yet this intemperature being excited by the coming of the Milk, is somewhat increased and continued longer, if that the Milk entring the Breasts in abundance, be not milked forth, but is again repelled from thence; for by its departure, as well as by its coming, a perturbation is wont to happen in the whole Body, with thirst and heat, which also more certainly comes to pass if it happens to be driven away violently, by repelling Topicks. But being driven by their help from the Breasts, or departing of its own accord, it is thrust forth, with the Lochia, in the form of a whitish humor, and a sweat, or more plentiful transpiration, exterminates the Reliques of the Disease. If that with this kind of intemperance, brought in by reason of the commotion of the Milk, the Lochia be stopped, or errors in eating and drinking be committed, or any other evident cause should happen, that may encrease the fervor of the Blood, very often the Milkie Feaver

Feaver, presently acquiring worse symptoms, changes into a putrid, or rather malignant Feaver.

The cause, for formal reason of the aforesaid Feaver (whilst the way of the Milk lies hid) may be only proposed, from an hypothesis, and as it were a certain Augury; for being supposed, that this milky humor is carried to the Breasts immediately, by a peculiar passage, from the Viscera of concoction, without any commerce with the Blood, this feaverish Distemper arises, for that the Breasts being filled with Milk, and greatly distended, the sanguineous Vessels are so compressed, that they do not easily transmit the Blood flowing thither; from whence, the Blood being hindered in its circuit, begins to tumultuate thorow its whole mass, and the Spirits being inordinately moved, and wholly confused, it conceives a fervor, such as being induced by a stopping, Surfeit, Inflammation, or Wound, constitutes ordinarily the simple Synochus; but if the matter of the Milk (as it is not improbable) passes thorow the Blood, this Feaver of Women in Child-bed, seems to spring from hence, that when this Latex is transferred to the Breasts, having left the Womb, a great portion of it subsists in the mass of the Blood, which indeed, for that it exceeds the due provision of the nourishing juice, and so cannot be wholly assimilated, and besides abounds in heterogeneous parts, and as it were something extraneous, and not mingleable with the Blood, creates a trouble, therefore for the carrying it forth of doors, and putting it forth, this three days feaverish Distemper is employed: For when the milky Chile, being used to be separated about the Womb, by and by, after being Delivered of a Child, that wax of excretion is hindered, restagnating into the mass of Blood, it is there first of all heaped up more plentifully, than that the whole may go into nourishment, or be received into the Breasts: wherefore, the Milk, not only in its passage to the Breasts, but also in its return towards the Womb, brings forth the Feaver, to wit, by reason of either passage thorow the Blood.

But however the cause of this Disease is ordained, it matters little or nothing towards the Cure; for this is wholly committed to Nature, and so long as the Lochia are in good order, it proceeds for the most part happily, without any Physical help: because, after the growing hot of the Blood, for three or four days, either a plentiful sweat, or a more free transpiration, cures this Distemper, to wit, either the Particles of the Milky humor, degenerate in the assimilating, or the adust recrements, remaining after the deflagration of the Blood, or both of them at once supplying the food or tinder of the Feaver, are by little and little subdued, and evaporated out of doors, which being excluded, the Blood becoming free from the extraneous mixture, quickly recovers its pristine condition; yet in the mean time, certain vulgar Rules are wont to be observed, about the admission of the Milk into, or the driving away of the same, out of the Breasts. If the Milk too plentifully springs into the Breasts, that their inflammation, as also the immoderate growing hot of the Blood, may be prevented, at that time, a more thin and sparing dyet, to wit, no flesh broths, and also in a less quantity, is to be ordered: also the Breasts are to be frequently drawn. If it be not commodious for the Mother to suckle her Child, it is usual after the first or third day of her being Delivered to cover all the Breasts over with Sear-Cloaths moderately binding (as the Plaister of Red-lead, &c.) for so the spongy substance of the Glandulas, is somewhat constrained, or closed together, whereby they less readily receive the milky humor flowing thither, yet this kind of Remedy ought to be cautiously administered, lest if the Milk be wholly excluded, or driven out of the Breast too abruptly, restagnating suddenly in the Blood, it induces its disorder, the prodromus or forerunner of the Putrid or Malignant Feaver: of which it remains that we speak next.

The Putrid Feaver of Women in Child-bed.

Women Lying in, from the fault of an evil affected Body, as by the Contagion of a received Pestilential Air, are found to be too obnoxious to the Putrid, or rather Malignant Feaver; but all do not alike receive the Infection of this sort of Disease; for poor people, Labouring Women, Country Women, and others accustomed to hard Labour, as also Viragoes, and Whores, which are brought to Bed clandestinely, bring forth without any great difficulty, and then, after a little time, leaving their Beds, return to their wonted Labours: But more rich Women, tender and fair; and most living a sedentary life, as if participating after a more grievous manner

manner of the Divine Malediction, bring forth in pain, and then presently after the Birth they are subject to difficult and dangerous chances; the reason of which seems to lie in this, that those who are used to much exercise, continually agitate and ventilate the Blood, and therefore fewer infectious taints from the monthly Fluxes being suppressed, do gather together for the matter of a Disease; moreover, laborious and nimble Women, as they have their nervous parts more firm, therefore they are less subjected to convulsive motions, and to the passions commonly called hysterical: on the contrary, in delicate, and idle Women, the mass of Blood, in the time of their going with Child, becomes very impure and fermentible; besides, because they have the system of the Nerves, and the Brain soft and weak, upon every light occasion, they suffer distractions of the animal Spirits, and inordinate motions of the nervous parts. And here, by the way, it is to be noted, that Women more than men and that some of the same Sex before others, are sensible of the affections called hysterical, not so much by the default of their Womb, as for that they are of more weak constitution of Brain, and nervous stock; for in those so affected, the passions of anger, sadness, fear, as also all troublesome and more strong objects, easily pervert the dispositions and functions of those parts, which, when they are once hurt, for the most part afterwards, are accustomed to those irregularities. But we will return from whence we have digressed. The Fever but now proposed, is wont to infect Women Lying in, indeed at various times, and by reason of divers occasions, now presently after the Birth, especially if it be difficult and laborious, now it arises in the first, now the second, third, or fourth week; yet the sooner it begins, the more safely it is wont to be cured. The Type or Figure of this Disease, is performed almost after this manner. After a previous indisposition, an open feverishness, for the most part with a shivering, or horror, constitutes the first assault, which is followed with heat, and afterwards succeeds a sweat: perhaps, for a day or two, they have various reciprocal fits of heat and cold; then the Blood being wholly inkindled, the Lochia, if not before suppressed, either flow small, or are wholly stopt: If the Disease be acute, and of a swift motion, it comes to its height on the third or fourth day, then an intense heat, with a very troublesome thirst, a vehement pulse, and quick pertinacious wakings, a great inquietude of the whole Body, that they are continually tossing themselves in their Beds hither and thither, a thick Urine, and high coloured, and other most grievous symptoms, are wont to trouble them: whilst the Fever is after this manner at its height no Crisis is to be expected; for I never saw this Disease cured by a critical sweat, but that the business was still very precipitously acted; as after the Blood was grown hot for a little time, presently the adult matter being translated to the Brain, most dangerous and heavy inordinations of it, and the whole nervous stock forthwith come upon them; for most often are stirred up, convulsive motions of the Tendons, wonderful distentions, and inflations about the Viscera, like to the hysterical passions; then sometimes, also follow a phrensie, or delirium, not seldom a stupefaction, and speechlessness; the strength is suddenly cast down almost in all, without any manifest cause, the Pulse becomes weak, and unequal; and the sick are suddenly precipitated to death: If that any perhaps escape, either by the return of the Flux of the Lochia, or a Lask, coming upon it, they hardly recover but of a long time: I have known in some, purple spots to have appeared, and certainly in many, symptoms that respect either the Blood or nervous juice, which argue no light Malignity.

We will distinguish the causes of this Fever, after the ordinary manner, into Frocatartic, Evident and Conjunct. Those of the first sort, upon which the malignity, and the greatest perniciousness of the Disease depend, are two, viz. first, a depraved disposition of the Blood, from the long suppression of the monthly Flux. Secondly, after the Birth, the evil affections of the Womb, from the dangerous Labours of Women, (who undergo the Divine Malediction appointed them) from the Menstrua being long suppressed, the Blood not only swells up, and its Sulphureous parts being too much carried forth, are rendered more apt for burning, but besides, the mass of the Blood is imbued with very fermentative Particles, so that (as hath been already hinted) as if it were touched with a venomous infection, presently growing fervent, it is disposed towards putrefaction, and corruptive disorders; and besides, forthwith impoisons the nervous Liquor, and renders it infestuous to the Brain and the whole nervous stock. These kind of evils, being impressed on the Blood, ought to be purged forth, by the Flux of the Lochia; but if after the Birth, the Womb be
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out of order, the Lochia are not only stopped, and so a purifying of all the Blood is hindred, but besides, stinking corruptions or defilements, are thence bestowed on the Blood, and grievously infect it: Also, by reason of convulsive motions, begun about the Womb, and from thence continued to other parts, inordinations are stirred up in the Blood and juices, which oftentimes conspire, either the production, or the acerbation or growing worse, of the Feaver.

The evident causes, which induce an actual effervescency, either to the Blood, having gotten an ill disposition, or invert the vices of the whole Body to the Womb, are after a diverse sort. A painful Labour, a solution of the unity about the Womb, a bruise, a retention of preternatural things, an ulcerous disposition, and very many other accidents, which are induced by a certain necessity, may do this. But the occasions, that are at the dispose of the Patients, and easily to be avoided, which are wont to excite this kind of Feaver, are chiefly two, viz. an ill manner of Dyet, and the taking of cold. It is an usual thing, to give to weak Women, after being Delivered, on the first or second day, the flesh of living Creatures, or Broths made of flesh meats, and other foods, very impropportionate to their dispositions, from whence presently arise an indigestion, and great trouble in the Bowels, and a feaverish distemper in the Blood, by reason of a more rich nutritious juice than ought to be. Besides, the errors in Dyet, oftentimes hurt is caused, for that their Bodies, being so very tender, also by reason of the labours of the Birth, and bringing forth the Child, the passages are on every side opened, they are exposed too heedlessly to the cold: for most of them, being impatient of their Bed, within a day or two, or sooner than they should do, rise out of it, and put on their Cloaths, from whence, presently the Pores of the skin being suddenly contracted, and the Air being admitted into the parts of the Womb, transpiration is hindred, and often the Lochia, on the sudden are stopped, either of which suffices to excite the feaverish distemper.

The conjunct cause, or formal reason of this kind of sickness, chiefly comprehends these three things, to wit, there are present, first, a very notable discrasie of the Blood, that growing hot, from the Feaver being occasionally induced, it doth not equally burn forth, nor leisurely overcome the adust recrements, and afterwards critically thrust them forth; but the Blood growing hot, is presently loosned in its mixture, and its frame being unlocked, turns and declines towards corruption; hence, when it grows but a little cool, the spirits being shaken out of their dominion, are moved into confusion. In the mean time, the Sulphureous Particles become untamed, and fierce, wherefore, the strength falls down without any manifest cause, the Pulse is made weak and disordered; after the deflagration of the Blood, altho the adust recrements are very much heaped up, yet nothing is rightly concocted or separated, but the sick being greatly oppressed in Nature, tho they continually sweat, receive nevertheless oftentimes no ease from thence; but the feaverish matter, which ought to be thrust forth, being transmitted into the head, and nervous stock, induces there most grievous perturbations of the animal regiment. Secondly, the Tragedy of this Disease owes no small part of it, to the nervous juice being presently made sharp, and so impropportionate to the Brain, and its Appendix; for this being infected, from the taint contracted from the Blood, doth not gently water, or pleasantly blow up its subjects, but notably hale or pull those tender parts, (as when an infusion of vitriol is poured upon a Worm) and irritates or provokes them into convulsions, and into motions, as if of dancing or suddenly leaping forth, and sometimes wholly overturns their functions; hence comes contractures, grievous convulsions, dilerium, wakings, and sometimes stupification, and the sleepy Disease, upon Women Lying in. Thirdly, whilst these things are done, oftentimes a third band of symptoms infect the sick, to wit, for that the Womb, being hurt by some evil, moves it self disorderly, and is struck with a Convulsion, according to these or those parts; from thence by and by, convulsive motions invade, by the membranes, and nervous passages, the whole Region of the Abdomen; wherefore, the Viscera and Hypochondria are blown up, belchings, and grievous vomitings are stirred up, then the Distemper creeping upwards, and possessing the nervous parts of the Thorax, a difficult breathing, and unequal, a palpitation of the heart, a sense of choaking in the throat, by reason of the Muscles being there drawn backward, and other symptoms, through the whole Body are excited, the same evil being at last carried to the Brain.

The Feavers of Women in Child-bed almost never want danger; but sometimes it happens, about the beginning, that they are cured by a slender Dyet, and by the Flux of the Lochia being restored; but if the feaverish distemper does root it self more deeply, that the whole Blood is inkindled, and immoderately grows hot, the Prognostick ought not to be esteemed of a light Omen; and there will be a greater reason of danger, if besides the heat being suffused all over, the sick are troubled with a frequent shivering, if they are affected or molested with a great disquietness, and wakings, with sudden concussions of the Body, or a contracture of the Tendons: or if, thirdly, they complain on the fourth day, of a tingling of their ears, with a great repletion or fulness of the head, you may from thence collect the evil to grow worse, viz. a translation of the feaverish and hurtful matter to the Brain; nor is it less to be feared, if they have on them an oppression, and weight of the *Præcordia*, that the sick cannot breath freely, nor draw their breath deep, and from the bottom of their breast, but only from the top, and that frequently, and sighingly, and that they move themselves restlessly hither and thither: For this argues the Blood to stagnate in its circulation, about the Heart and Lungs, and also to be apt to grow into clodders, and to be coagulated: that if yet worse distempers of the Brain and nervous stock follow, and the Pulse should become weak and unequal, you may pronounce the business almost deplorable; but if (as sometimes tho it more rarely happens) after the Feaver being inkindled, and grievously threatening, either the Flux of the Lochia returns, or a Diarrhea with ease succeeds, some hope of health may be admitted, tho the same bear the last cast.

Concerning the Cure of these kind of Feavers, there lies a very great task upon the Physician, because any Physick is esteemed with the vulgar, not only unprofitable, but also hurtful for Women in Child-bed; wherefore, Physicians are rarely sent for, unless when there is no place left for remedies, and the opportunity of all profitable means be wholly past: If that perchance they should be present, about the beginning of the Disease, it will not be easie to procure health to the sick by vulgar Remedies; but whatever they should attempt, unless it should bring help, it would be said by the Women, and others about the person, to be deadly. and the only cause of her death; that in truth there is wont to happen to us, less of profit, or more of ignominy, about the Cure of no other Disease, as in this.

But the method of curing (even as in Contagious Diseases) ought to be instituted twofold; to wit. Prophylactic or Preventive, and Therapeutic or Curative: The former of these, delivers precepts and cautions, whereby Women Lying in, may be preserved from the assault of Feavers: the other suggests Curative intentions, whereby the sick (if it may be done) may at length recover health.

1. Although this Feaver be somewhat Malignant, it is not caught by Contagion, and there is no fear of the sick receiving outwardly any invenomed taint; notwithstanding, all Women in Child-bed, have an innate mine of virulency, and from the evil of this, as it were the tinder of most high Malignity, they ought to beware; wherefore, they need an exact ordering, to wit, whereby after the Birth, the impurities of the Blood and humors, may be rightly purged forth, without danger of a Feaver; also, that the evil affections of the Womb, may be healed, and that the strength being broken and debilitated, by the Labour, may be restored after its due manner. For these ends, these three things are chiefly to be inculcated, for precepts by Physicians. First, I judg it necessary, that a most exact manner of Dyet be commanded to Women in Child-bed; to wit, that they be wholly fed with Oatmeal Caudle, made sometimes of Beer, and sometimes of Water and White-wine mixt together, also with Panada, and other light nourishers, for a week at least; because they are much emptied, therefore it may be lawful for them to sup often, but nothing of solid or more strong food is to be given. For I have diligently observed that these Feavers have been oftentimes induced, by the eating too soon flesh, or strong Broths or Food. Forasmuch as Women Lying in, ought to be handled, not only as those that are grievously wounded, but as those that have got a feaverish indisposition, from a disturbed disposition and temper of the Blood: For with them, the Blood being already too much carried forth, and as it were touched with an impure infection, most quickly catches Flame, by the access or means of any Sulphureous thing. Secondly, after Dyet, the care will be, lest the Pores be shut up, by the incautiously taking cold from without, or that the Lochia should be stopped: for upon the least occasion, the manner of transpiration being changed, the Blood first growing hot, conceives disorders;

orders : also the Womb being touched by the blast of Air, contracts it self, and shuts up the mouths of the Vessels, whereby the Lochia flow forth less : wherefore, for five days at least, after being Delivered, I would have Women wholly to keep their Beds. I know that 'tis a common custom, to raise them from Bed on the third day, but by that means I have known many that have fallen into Feavers; and in truth, if we desire to keep Women in Child-bed from all danger, the safest means will be, that they may be kept long in their Beds. Thirdly, concerning preservation, the intent remains, that by causing a gentle provocation of the Blood, in Women Lying in, the Flux of the Lochia may be continued : for this end, Midwives are wont (if after a difficult Labour they fear that evil) to give them *Sperma Ceti*, or powder of *Irish Slate*, or Saffron steeped in White-wine : Moreover, to make them Oat-meal Caudle, that may more fuse the Blood, of Water, and White and Rhenish Wine mixed together, in which they boyl, or in posset drink also, Marigold Flowers, leaves of Pennyroyal, or Mugwort, there are many other kinds of administrations extant, about the ordering Women in Child-bed, which being commonly known, I willingly pass over here.

The Cure of the subsequent Feaver of Women in Child-bed, is far from the usual method in Putrid Feavers : for in this, it is not to be expected, that the Blood being touched with a feaverish burning, should by degrees burn forth, and the same should be separated by a Crisis, but rather (as it is done in a Malignant Feaver) as soon as the Blood grows immoderately hot, it is convenient for it to be moved by gentle Diaphoretick Remedies, and its heterogeneous and impure mixtures to be carried forth of doors ; wherefore, among the common people it is a custom (and that not bad) to give to feaverish Women Lying in, sudorificks presently : by this means, the Blood being eventilated, its effervency is allayed ; also, by reason of its agitation, the Lochia apt to be restrained, are provoked into a Flux. There is great difference among Authors, from whence the beginnings of these kind of Feavers ought to be computed, viz. whether from the Birth it self, or from the first sense of growing feaverish ? however it matters little whether it be after this or that manner : For since this Feaver runs not the usual stadia or courses of the Putrid, neither hath a Crisis, nor wholly admits the use of Cathartic or Purging Remedies, we need not be solicitous so much for the days, concerning its period and mensuration. But yet, as to the Curative indications, it will be of use only to distinguish what is to be done in the beginning, increase, and end of this Disease : also, what we ought to endeavour whilst there is some strength remaining, as also what, when 'tis oppressed, and very much dejected.

When therefore any Woman in Child-bed is first taken with this Feaver (whose assault is known from the milky Feaver, because for the most part it begins with a shivering) you must presently let it be your work, that the more plentiful sustenance may be drawn away from the burning Blood, and as I have already admonished, that the flesh of living Creatures, and Broths made of them, be utterly forbidden ; yet in the mean time, all cold things, and that are indued with a styptic or binding vertue, are equally to be avoided ; for these fix the Blood, and bind it too much, and hinder its very requisite Purgation, both by the Lochia, and by transpiration thorow the skin. But rather, though the Feaver be urgent, give them decoctions, powders, and confections of things moderately hot : of which sort are, (as is already said) decoctions, or Distilled Waters of the Flowers of Marigolds, the Leaves of Pennyroyal, Mugwort, the roots of Scorzoneria, also Bezoartic Powders, Spirits of Harts-horn, fixed salts of Herbs, &c. If the Lochia should be stopt, that their Flux may be again provoked, must be endeavoured every way : To the moving of this, conduce frictions and ligatures about the Thighs and Legs ; sometimes Cupping-Glasses, or Blisters about the Thighs or Hips, also in the soles of the Feet : also, sometimes the opening a Vein in the Ankle is convenient, in the mean time a fomentation of the hysterical decoction, is to be applied about the Pubis, or the Caul of a Weather or Sheep, taken out warm, may be layed to the bottom of the Belly ; and experience manifests, that sometimes injections into the Womb are profitable : If the Belly yields not, it may be gently brought down, with a violet suppository so called, or an emollient Clyster ; of more strong provocations you must take heed, because in Women Lying in, even as in a Malignant Feaver, from a copious dejection, with loss of Spirits, Life is quickly lost. If with the suppression of the Lochia, there be a notable perturbation of the Blood, with vomiting, thirst, and wakings, I have often known,

Laudanum mixt with Saffron, given with happy success. Instead of a cooling Julep, this kind of mixture is convenient, *viz.* take of water of Pennyroyal, and Balm, each three ounces, of hysterical water two ounces, of the Syrop of Mugwort three ounces and an half, of the tincture of Saffron two drams, of Castor ty'd in a rag, and hung in the glass, one scruple, mingle these, and let them drink of this three or four spoonfuls oftentimes in a day.

2. If notwithstanding the use of these Remedies the Feaver grows still worse, and by degrees is increased with worser symptoms, that besides the disorders of the Blood, the Brain and nervous parts begin to be touched, Medicines, tho many of every kind may be tryed, do little; yea, in this case the indications are almost the same, with those made use of in the Plague it self: forasmuch as the Lochia being for a good while suppressed, they cannot easily be reduced, or scarcely at all, in the great confusion of the Blood and humors, therefore it is convenient quickly to move a sweating, to wit, that the corruptions, impressed on the Blood and nervous juice, and re-stagnating from the Womb, may be carried forth some how, by sweat, and insensible transpiration. Therefore here, Powders, and Confections of Bezoar, Spirit of Hartshorn, or of Soot, tinctures of Corals or Pearls help. I have sometimes seen, by the help of these kind of Medicines, in a desperate case, when the Pulse, and other symptoms have appeared a little better, some small hopes to shew themselves; yet Cure rarely to follow: but when the use of these Cordials were left off, the sick with a weak Pulse, and a Loosness presently arising, have been precipitated to Death.

3. When yet the business of the sick proves still worse, when the Feaver being increased, the Pulse is weak and unequal, and frequent horrors, and convulsive motions in the whole body, with a delirium, and stupefaction infest them; then the Physician having first made a Prognostication of Death, may insist upon a few Remedies, and those only Cordials, and must wholly abstain from blood-letting, scarification, blistering, or the use of Cupping-glasses: for such administrations beget only an odium and blame, that by so doing, we are esteemed by some Women, as wicked and cruel.

The Symptomatic Feavers of Women in Child-bed.

THE Acute Diseases of Women in Child-bed, shew themselves not only according to the Figure of the aforesaid Feaver, but sometimes they are beset with some signal symptoms, to wit, the Squinancy, Pleurisie, inflammation of the Lungs, Dysentery, Small-Pox, or of some other kind; and at that time, they get the appellations of those Distempers. It will not be here seasonable, to repeat at large, what belongs to the essences and natures of each: but I shall briefly shew, what these sicknesses, being complicated with the distempers of Women Lying in, contain peculiarly, as to the Causes or Cures.

All these symptoms, we suppose to proceed, from a certain Coagulation of the Blood, and from thence its extravasation: But whilst the Blood is extravasated, or put forth of the Vessels in one part, its efflux, however natural, and critical, is hindered in another: wherefore it is dangerous, lest whilst the Blood begins to be coagulated, either in a particular or accustomed nest of Coagulation, or universally in its whole mass, the flowing of the Lochia be stopped, which in truth for the most part happens, and therefore these Distempers, for the most part, are deadly to Women in Child-bed: yet the cause of their Death, for the most part, happens with some difference, *viz.* in the Small Pox, the flowing of the Lochia, draws inwardly the malignity, begun to be carried forth outwardly, and forthwith compels the mass of Blood, and the heart it self, to be impoysoned, with its evil; and therefore in the Small Pox, these purgings of the Womb, are convenient to be stopped: But in the Pleurisie, Squinancy, and the rest, when the provocative of the Disease, being fixed here or there, in a particular place, draws to it self the impurities of the Blood, which ought to be separated or sifted forth by the Lochia, and derives it streight from the Womb, for that reason it increases the impurity of the Blood. The Lochia being stopped in the Small Pox, by the more universal manner or way of excretion, may be shut forth of doors, with the venemous Particles of the Disease, which thing indeed does not succeed in the rest, by reason of the minute, and more sparing manner of excretion.

Of these, the Squinancy, Pleurisie, and Inflammation of the Lungs, by reason, both of the great similitude of the Cause, and analogy of the Cure, may be considered together: when any Woman Lying in is distempered with any of these, it is to be supposed, that besides the Infection, gathered together in the time of being Bigbellied, there happens a certain sourish disposition of the Blood, by the means of which, whilst that it self grows feaverishly hot, certain Particles of it, being fused with the sourness enter into congelation, in this or that part, like Milk growing sour, and then to be coagulated: The Blood being there frozen or congealed, and hindred in its circuit, stops the passage of the rest; but the Blood being obstructed in its motion, butts against the impediment, and so being heaped up about it, and driven forth of the Vessels, grows into a tumour: from thence presently, whatsoever is contained in its mass, that is heterogeneous, and to be sifted forth, is layed aside into the distempered part, as it were a sink: wherefore, the corruptions of the Blood, that ought to be purged forth by the Womb, are derived from thence towards the nest of this Disease, which, when they cannot be sufficiently purged forth by this way, both more remarkably corrupt the Liquor of the Blood, and render the particular distemper, *viz.* the Squinancy, Pleurisie, or any other more hard to be cured.

For the Cure of these kind of complicated distempers, presently from the very beginning, it should be endeavoured, that the Blood being fixed somewhere, and begun to be extravasated, may be restored to Circulation, that it may not impostumate; because, very rarely, Women Lying in, are cured of these Symptomatic Feavers, by an Imposthume, or spitting forth of the corrupt matter: Wherefore, internal Remedies, which fuse the Blood, and free it from Coagulation, are to be made use of; of which sort are chiefly Diaphoretics full of a volatile Salt, as Spirit of Hartshorn, Soot, Urine, also the Salts themselves; in like manner Shelly and Bezoartic Powders, Lapis Prunellæ, Decoctions and Juleps of Vegetables provoking Urine, or the terms, with all which ought to be mixed, what by experience are found proper for the distempers of the Womb: Besides, discussing Remedies, which may drive away the impacted matter, and disperse it (of which sort are Liniments, Fomentations, and Cataplasms) are diligently to be applied. In the mean time, the more impetuous motion, and immoderate effervency of the Blood, are to be removed, and its purgings, by all the ways possible transferred to the inferior parts. For this end Frictions, Ligatures, Epispastics, and (if need be) Scarifying about the Feet and Legs, are to be administered; if the distemper very much growing worse, a taking away of Blood be indicated, unless there be a great fulness in the whole Body, and a very acute inflammation in the distempered part; it will be best to open a Vein in the Foot, or to take away Blood from the hemorrhoid Veins by Leeches: But if necessity urges, it may be done in the Arm it self; if after that Letting Blood (if another be admitted) let it be done in the Leg; but you are to be warned, that in these cases, the opening a Vein is to be ordered very cautiously, for unless it brings present help, (which I have rarely known it to do) immediately the Pulse being made more weak, the business of the sick becomes much worse.

The Dysentery takes its rise almost for the like cause, with the aforesaid distempers; but in this, because the extravasated Blood is presently poured forth, nor being retained in the Body, becomes there troublesome, or is any more corrupted, and as this Flux makes an excretion near the Womb, and does not afterwards drive it to any other place, there is less of danger to be feared, from this Disease, than from those aforesaid: yet oftentimes this Disease is fatal to Women in Child-bed, for that indeed, the rather, because things attempering the Blood, and moderately binding, are ordered for the Dysentery: for these are found too apt to inhibit the Flux of the Lochia; wherefore in this case, until the Women Lying in are sufficiently purged by a long Flux, the Cure of the other Disease is to be omitted, and the fierceness of the symptoms is to be allayed, only with gentle asswaging things.

The indications of the Small Pox, do not only differ from those above described, but indeed they are beset with contraries to themselves; for they require (as hath been said) that the Flux of the Lochia should be moderately staid: yet in the mean time, that the flowing forth of the Blood, and a gentle sweat ought to be continued; for when in this Disease, the invenomed ferment is twofold, and the corrupt Particles of the Blood, are carried outwardly in a twofold way, you must beware, lest that the lesser, and straiter part, should draw to its door, the whole matter, or more than it were able to send forth: therefore, lest the Lochia flowing more plentifully,

tifully, should recall inwardly the venom, apt to flower outwardly, the manner or way of Dyet is somewhat to be changed, and specially those things which have a poyson resisting force, and are also astringent (as the roots of Tormentil and Bistort) are to be boyled in the Broths of the sick; also Powders, Juleps, and Opiats, indued with such like virtue, are convenient to be administred at due intervals: yea, in this case, by no means, Women should be indulged, that they might eat flesh, or Broth made of it, or to rise out of their Bed: but the quiet, both of mind and Body, is to be procured, as much as may be, and a Dyet to be ordered of those things, that move not the Blood, and the business almost wholly to be committed to God and Nature.

What hath already been said, concerning the acute Diseases of Women in Child-bed, may easily be illustrated with Histories and Observations: But examples which may be brought in this thing, for the greatest part, are mournful and of an ill chance: because those Feavers for the most part end in Death. But to describe these kind of sicknesses, does neither confirm the work of the Physitian, nor render approved the method of Medicine, altogether taken in them; however, because the knowledg of these may make for the better discovery of this Disease, I shall here propose some singular cases of Women Lying in, and variety of symptoms; in which, altho the forms and means of Cure more sparingly occur, yet we may have some rules of precaution, of no contemptable use.

A Gentlewoman in her six and twentieth year of her Age, brought forth her sixth Child, with very difficult Labour, and not without danger of her Life; yet presently after, she began to be better; on the second day she eat a whole Chicken, on the third rose out of her Bed, and sat in a Chair for four hours; the night following she found her self ill, at which time her Milk came into her Breasts; which, by the application of Diaculum Plaisters, soon vanished; the next morning she complained of a weariness, and as it were an ulcerous pain of her whole Body, also of a vomiting, nauseousness, and fulness about the Ventricle, and Hypochondria: the following night was full of trouble; on the fifth day she was plainly in a Fever, she felt now a shivering, now a heat, every where increasing, she nauseated every thing, and was troubled at her Stomach, moreover being unquiet, and without sleep, the Lochia flowed little, but a whitish humor (commonly called the Flux of the Milk) came away: In the evening she had a weight, and as it were a sleepiness about her forehead and temples, and began to sleep a little; but awaking in half an hour, being disturbed with Phantasms, she complained of her head, as if increased in bulk, also of her jaws being set, that she could not open her teeth, and her fists being strongly clutched, she seemed as if she felt a pricking and stupor, or numbness in her whole Body; her Ventricle and Hypochondria stood still inflated, and stretched forth; they administred to her Frictions, Ligatures, Cupping-glasses, and other Remedies, both inward and outward, that might recall the Lochia, and drive the recrements of the Blood from the head: Her Pulse being weak, and disordered, would not admit of Letting Blood; Powders, and Juleps, which might gently move sweating, and fuse the Blood and nervous juice, and hinder them from restagnating, were diligently given her; yea, fomentations, now of Wollen Cloaths dipped in emollient Decoctions, and now of warm inwards of living Creatures, were applied to her Belly; in the mean time, stinking things (such as they use to the Mother Fits) were put to her nose, which might drive away the impetuosity of the Spirits and Blood, carried into the head, but these, and other things, being for several hours carefully performed, she seem'd to feel some ease; but still she feared to shut her eyes, or to settle herself to sleep, for her eyelids being closed, a thousand Phantasms ran in her mind, with noise and tingling in her whole head: she continued that night almost without sleep; as soon as she had begun to sleep, presently being affrighted, and feeling a weight in her Precordia, she was awaked: on the sixth day about noon, she was troubled with a great shivering, or rather an horror, with a strong concussion of the whole Body; to which, as in the fit of an Ague, by and by heat, and then sweat copiously followed: but from thence, nothing of ease accrued to the sick, for presently after the sweat, the feaverish heat was renewed, and convulsive distempers infested her more: the night following, with the rest of the symptoms growing worse, first a Pallie was excited in her tongue, and by and by in her throat, that she could not speak, and scarce swallow at all: on the seventh day, about the same hour, a shivering invaded her again, with heat and sweat; then her Pulse being much weaker, and

and unequal; also a difficult breathing, and fetching the breath short and quick, with her Breast lifted up, she knew not them about her: on the eighth day she died.

There was a manifold occasion of the death of this Gentlewoman, predisposed to a Feaver, by reason of her Big-belly, and which had increased the malignity of the Disease over and above; for the hurt received by her hard Labour, the sudden exclusion of the Milk from her Breasts, the eating of flesh, and the rising too soon out of her bed, hapning together, made as it were a conspiracy for the greater evil: The Blood being touched with a feaverish burning, presently conceived inordinations, and snatched into it self the Lochia, and perhaps other defilements of the Womb, and so by that means acquired a greater infection, and plainly venomous disposition; the membranes of the Viscera, being imbrued with the degenerate nervous juice, were struck either with Convulsive motions, or with Convulsions continued to them from the Womb; for these kind of inflations, about the Abdomen, and those distentions are the effects of Convulsions: For altho the direct Fibres drawing the member do oftentimes press it, yet since the Fibres are direct and transverse, and others placed in a various site, the membranes are pulled together into an hollowness, by their coming together, the part swells up like a blown bladder, into whose vacuity the Air being rarefied secondarily carries it self forward: But it is not the Air (as is commonly said) or a blast there at first heaped up, that is the cause of the distention. The Blood growing hot in our sick person, and being quickly filled with an adust and malignant matter, did endeavour to subdue it, and being unable to put it forth by sweat, forthwith fixed it in the Brain; the first suffusion of the same matter into the head, by reason of the animal Spirits being half overthrown, brought in that sense of her head being much increased in bulk; which thing happened by the like means, as when the foot being taken with a sleepiness, seems as if it felt much bigger than it is: But that after some ease, the distemper grew worse, by sleep and closing of her eyes, the reason is, because waking, and the exercise of the senses, shake off and remove from them, somewhat, the matter besieging the Brain and Nerves; which notwithstanding being neer and in its precincts, sleep creeping on, is as it were supped up by them, and enters their Bodies more deeply with the alible juice. But the Blood, altho it had plentifully poured forth its recrements in the Brain, yet did not itself become free; but being still full, with an impure ballast, it conceived as it were a critical flowring, and attempted to shake off its burthen once or twice (as it is wont in a great excretion) with a shivering, and with heat and sweat following it, by which endeavour however nothing was further effected, than that the matter sticking to the Brain, pierced more deeply into it, and becoming fixed in some little shoots of the Nerves, took away her speech and swallowing, and afterwards her senses; and the mass of Blood, being by degrees more and more depraved, at length became unable to sustain Life.

A noble Gentlewoman, being married a little before she was twenty years of Age, and being with Child, used, during the time, an ill dyet, and little or no exercise; yet falling into Labour, and suffering the torments with intermission, and frequent ease for twelve hours, at length was brought to Bed of a Son: The Child, with the after-birth came away, and all things were right about the Womb: the first and second day she found her self indifferently well, but on the third, after a light shivering, she began to complain of thirst and heat; to which a looseness followed, that she had that day four stools: the following night she was almost without sleep, the feaverish distemper remained, after that, in the same manner for two days; daily she purged three or four time; the Lochia as yet flowed moderately: when on the sixth day, by the persuation of the Women, she had took some astringent thing, to moderate the Flux of her Belly, the purgings of the Womb were almost wholly stayed: at which time the Feaver became more strong, and symptoms as it were hysterical appeared; for in her Precordia, she had great and frequent oppressions, and was troubled with a sense of choaking in her throat; on the seventh day, the heat was yet stronger, and her breathing difficult and laborious; but then, by the prescription of a Phyician, at that time first sent for, Blood was taken from her foot to three ounces, by which she was better for four hours; for a quiet sleep, with a plentiful sweat followed upon it, and the Lochia appeared again tho in small quantity: In the Evening again, all things grew worse, her strength being very much lost, her Pulse weaker and unequal; she complained also of a noise and tingling of her ears, with a fulness of her head, moreover a leaping up of the tendons in her wrists; also she had sudden con-

concussions of her wholly Body, yet still her looseness held; to her were administered, by the prescripts of several Physicians, Cordials, and other Remedies, and kinds of Administrations carefully, but nothing profited: her Pulse being more weak, and her strength leisurely wasting, she died on the ninth day, after she was delivered.

This Feaver very much depended upon the vicious provision of the Body, as the procaccian cause; for I have often observed, that it fares ill with Women Lying in, who when Big bellied devoured fruit, and any unwholesome trash, and living without motion or exercise, indulged themselves with ease and rest: the Blood, by reason of the previous Cachexie, conceived a burning without any evident cause, as it were of its own accord: But growing hot, laying inwardly still its recrements, and impurities, caused the Diarrhea: neither yet was its mass made more pure, by its almost continual excretion, yea, rather being still more depraved in its mixtion or crasis, the Blood at length wholly departed from its proper disposition, and became unable to be fermented in the heart, whereby heat and breath might be every where dispersed: The looseness, excited by the motion of Nature, was untowardly stopped, especially by the use of astringent things; for this I have often observed, never to be done without paying for it; because the Flux of the Belly has cured some that have been ill, but in this Lady, and in many others (as has abundantly appeared to our experience) altho it did not take away the Feaver, yet it freed her from the more grievous distempers of the Brain and nervous stock: from whence this sick person was wholly free from a Delirium, nor was struck with Convulsive motions, till reduced almost to extremity.

The Mother of a Family, and a Gentlewoman, about 36 years of Age or upwards, being with Child of her seventeenth Child, was troubled, and very anxious, lest she should die of that Child-bearing: But (God favouring) she was delivered well enough of a Son, and for three days after she was very cheerful: on the fourth day, when she had eaten more than she should do of a Chicken, a little before night she fell into a feaverish Distemper, with vomiting, and a stopping of the Lochia: all night she lay restless and without sleep, the next morning she had four stools, and seemed somewhat eased: about Noon (about which time I came to her) she complained again of heat and thirst, as also a palpitation of the heart, and of the ascent of some substance in her throat: her Pulse was quick and small, her Urine red, the Lochia scarce appeared; I ordered her Juleps, Cordials, and things to purge the Womb, besides a fomentation for the bottom of her Belly, also her Legs and Feet to be rubbed often, with warm Wollen Cloaths; at going to sleep I gave her of Laudanum one grain, with Saffron Pouder half a scruple, in a spoonful of Treacle-water: She slept well, and the Lochia came down plentifully, and by that means, with a slender dyet, and continuing to provoke moderately the Flux of the Womb, for a few days, she became very well.

The immoderate eating of flesh, as an evident and almost only sufficient cause, without any great provision, or vicious predisposition, induced the Feaver. The Lochia reflaguating into the Blood, increased its intemperance, and presently brought troubles upon the nervous kind; but in the mean time, the Blood altho growing hot, did not undergo any great corruption, but when the recrements, heaped up by the Surfeit, were sent forth by the looseness, and the Blood, the Lochia being restored, began to be purged forth again after its wonted manner, this Feaver wanting a further malignant ferment, quickly vanished.

A noble Lady, young, and fair, was brought to Bed of a second Child, and for six days, as to the Lochia and other accidents, she was well, and wholly free from the suspicion of any intemperance: she ate flesh daily, and rising from her Bed, was brisk and chearful in her Chamber; on the seventh day, without any manifest cause, a shivering came upon her, with a Feaver, and a lessning of the Lochia, but not suppressed: to the tenth day after her Delivery, she was only moderately feaverish; whilst the purgings of the Womb yet flowed, she remained free from any grievous symptom: but then, although she was greatly feaverish, she was more cheerful than ordinary, and seemed more confident of her health: at Night she slept little or nothing; the morning following (at which time I first visited her) she clearly raved, the Lochia were stopped, also her whole Body was shaken with horror, the tendons in her wrists were pulled together, so that I could hardly distinguish her Pulse, which in the mean time was weak, unequal, and very quick. I said she would die quickly, unless God should miraculously restore her by his Divine Power, however, six grains of

of Oriental Bezoar being given her, in a spoonful of Cordial Julep, brought upon her a plentiful sweat, with a better Pulse; then other Cordials being given, with due intervals, gave some little hopes, tho I doubted they would not continue: after four hours from the time that I came, the sick Lady had of her own accord a great Stool, and presently her strength wholly failed her, and within half an hour she died.

When there hapned nothing of ill to this Lady, as to her Delivery, or Womb, so pernicious a Feaver, and so suddenly Mortal, could not happen without a great and malignant procatarsis of the Blood and humors: whether a more full Dyet, or taking Cold, or any other evident cause, gave a beginning to this is uncertain; because, the Women and Nurses helping her, knew of no manifest occasion of her sickness: The Feaver being inkindled, the infection of the Blood could not be wholly carried away, by the purging of the Womb, tho long continued; tho for that reason, the more cruel symptoms came not presently upon her, yet the evil still lurked within, and the Disease being very acute, shewing it self with a swift motion, on the fourth day, when Nature should have indeavoured a Crisis, the matter of the Feaver being moved, but not overcome, as it were in a moment overturned at once, the Brain and nervous parts, whence Death was to be expected, and suddenly followed.

A Woman well known, who had scarce passed the twentieth Year of her Age, of a florid countenance, and slender Body, after her being brought to Bed, when the Lochia flowed immoderately, made use of some astringent Remedies, by the counsel of those about her, by which means they were wholly stopped; but a Flux of her Belly succeeded, which when it had increased for three days, the Women gave her other things for the stopping her Loosness: nor were they frustrated in the success; in the mean time, in the place of the former evil, they had brought a most dangerous Feaver, and distempers as it were hysterical: for the unhappy Gentlewoman Lying in, was troubled with thirst, heat, wakings, and at several turns, with swoonings, and cold sweats; at this time being sent for, I prescribed her Cardiac Remedies, and such as moved the purgings of the Womb, and also a Clyster to be given her: at length, the Flux of her Belly being provoked, the Lochia also came down, and the sick Woman being freed from the aforesaid symptoms, and the more grievous Disease, to wit, the Remedies of the Nurses, quickly grew well of her Feaver.

The more plentiful Flux of the Womb, hapning to this Woman, removed the Procatartic cause of a more grievous Disease: wherefore, when they had committed so many errors about the ordering her, (*viz.* first in stopping the Lochia, then what might compensate their defect, in hindring the Flux of her Belly) yet the Feaver was only light, and without any venomous taint impressed on the Blood; the like to this I have known to happen frequently, to wit, when at first the purgings of the Womb have flown very plentifully, afterwards when they have flown very sparingly, and sometimes stopped, the Women in Child-bed have escaped. And by the way, it is here to be noted, that it is wholly dangerous, to inhibit, or at least divert, and cross any motion of Nature, incited, tho irregular.

A Noble Gentlewoman, about 20 years of Age, indued with a smooth and full habit of Body, miscarried twice in the space of a Year; when she had again Conceived, by the prescription of her Physician, she provoked a Vomit once a month, by drinking plentifully Posset Drink, by which she was wont to cast forth much thick tough Phlegm, also in the time of her being with Child, he Let her Blood 5 times; the time of her going being over, she was brought to Bed of a Son, with very hard Labour; the Secundine came whole away, and she purged notably: on the second day, whilst she was lifted upon her feet in Bed, that the Sheets and the Blankets might be laid in better order, she took Cold, and by that means the bloody Lochia wholly stopped, and only a little serous Water came away: on the third day she began to complain of an acute pain in her right side, to which the Women laid Bags of Camomil made hot with Bricks, but the distemper grew worse with a bloody spittle; on the fourth day of her being brought to Bed, a most sharp pain, with a difficult breathing, and very Laborious, invaded her: by the prescription of her Physician, then coming to her from the neighbourhood, six ounces of Blood was taken away, out of the Basilic Vein, and she felt sudden ease, for 10 hours she was better, in the middle of the night the pricking pain returned with its wonted fierceness: at length, other Physicians being called to Counsel, they agreed that it was necessary to open a Vein again, in the arm of the distempered side: four ounces of Blood being taken away, the pain remitted, and the sick breathed better; then by Diasphoretic Remedies, she

fell into a great sweat, with a quiet sleep: But the Pulse was made quicker and weaker, also contractures of the tendons in her wrists appeared: presently afterwards she talked idly, and within 24 hours, after she was last Let Blood, she departed.

That this Lady fell into a Pleurisie, with a Feaver, upon the Lochia being suppressed, the cause in some measure seemed to be, the Letting of Blood so often in the time of her being with Child: for by this means, the Blood being accustomed to be even-tilated at the arm, afterwards growing hot, leaving the Womb, was carried violently towards the place of its letting forth, where, when it found not a passage, it fixed in the neighbouring side, as the next next to the place of extravasation; yea, besides the usual manner of a Pleurisie, there was no small malignity hapned to this Disease; for the Blood being hindred from being let forth of the Vessels, began presently to be corrupted in its disposition, and in the third day of the Feaver, was so much depraved, that it could not be any longer fermented in the heart so as to Prorogue Life.

It was not so with the Wife of a certain Smith, who was brought to Bed, at what time her Children had the Small Pox in the same House, and she her self, as it seemed, had taken the Contagion of the same Disease, for on the second day after her Delivery, they began to break forth with a feaverish heat, and pain in her Loyns, which indeed for three days, whilst the Lochia moderately flowed, arose rightly into little swellings; altho the purging of the Womb was very copious at that time, she had the Small Pox very thick all over her Body, not only in the superficies of her skin, but also they filled the cavity of her mouth and throat, so that she could scarce speak or swallow: The sixth day of her Lying in, the Lochia flowed immoderately, from whence presently fell upon the sick, a frequent swooning, with a flagging of the Small Pox, Convulsions, and other symptoms of an ill nature, which threatned Death soon; being sent for, I prescribed half a dram of this Powder, to be taken constantly every three hours, in a spoonful of the following Julep, *viz.* take of the Roots of Tormentil in Powder, drams two, of the best Bole Armonie dram one, of the species of Hyacinth half a dram, make a Powder. Take of the Compound Water of Scordium, of Dragons, of Meadowsweet, each three ounces, of Theriacal Vinegar one ounce, of the Syrup of Corals two ounces, of Harts-horn burnt half a dram, make a Julep. Besides, I ordered to be boyled in her Broths, and in every thing she drank, the Roots of Tormentil: by these Remedies, the purging of her Womb was soon wholly stopped, and the Small Pox by degrees being ripened, came off without any grievous symptom.

Indeed this case was difficult, and was cured with great danger, *viz.* for either the Lochia, or the Small Pox to have been restrained inwardly, was very dangerous, and yet the more full eruption of the one, hindred the motion of the other; so long as either moderately proceeded, things being permitted to the conduct of Nature was moderately well: but when one of them became ill, the work of Art was required, and it was requisite to bridle the Lochia, but to provoke the Small Pox.

C H A P. XVII.

Of Epidemical Feavers.

HAVING meditated rather a Commentary, than an intire Tract, I had thought here to have concluded our Discourse of Feavers: But forasmuch as certain Epidemical Feavers do often spread, which observe no Laws, nor can be brought to any certain rule of Doctrine, but being irregular vary every year, and for that reason, as often as any of them increase or spread abroad, presently it is called the new Disease; therefore, I thought it worth our while, because general precepts concerning these Feavers are not to be delivered, to subjoyn some particular Histories, of some of this kind; for out of the various provision of symptoms, whereby they are wont to be noted, the nature and the whole formal reason of these kind of distempers, may somewhat appear. Since therefore of late years, within a short tract of time, three popular Diseases have spread in these Countrys, I will add, as a Crown to this work, the several Descriptions of them, made at those times, when these Feavers raged.

A Description of an Epidemical Feaver, spreading about Autumn, in the Year 1657. taken in the middle of September.

WHILST we meditate the Description of a Feaver, at this time cruelly raging, it is fit, that following the example of *Hippocrates*, we first consider the foregoing constitution of the Year, its intemperance and excess of qualities. For Epidemical Diseases, and commonly excited among the people, are from a common cause; such as the habit of the Year, and by that means contracted, a disposition of the Blood, by which many are alike affected. But that we may draw the matter from the beginning, the last Spring, and the time succeeding it, even to the end of the Summer, was all that half years space extremely dry and hot, but especially after the Summer solstice, the heats were so intense for many weeks following, that day and night there was none that did not complain of the heat of the Air, and were almost in a continual sweat, and were not able to breath freely: About the Calends of *July*, this Feaver, at first sporadical or particular, began to break forth in some places, that perhaps one or two were taken in the same City or Village: In many it imitated the likeness of an intermitting Tertian, *viz.* the Fits returned every other day; which yet infested the sick with a most intense heat, without any cold or shivering going before; Vomiting and Choleric Stools plentifully hapned to most, sweat succeeding but difficultly, and often interrupted, whereby the feaverish fit rarely ended in a remission, but that all the time between, the sick continued languishing and weak, with thirst and restlessness; in some, when the business began to grow better, after three or four fits, cold and shivering began the fits, and the Feaver became an exact intermitting Tertian: But in most, the Feaver still grew worse, and presently became of an evil nature, and difficult Cure, with a depraved provision of symptoms; for when the sick were highly heated in their fits, and hardly sweated, they were wont to commit errors, which daily increased the strength of the Disease, because by reason of the impatience of the sick, and the unskillfulness of Servants, the sweat being interrupted, which should have ended the fit of the Feaver, after one fit was scarce finished, another presently succeeded, and so the Disease was wont to have wandering and uncertain periods, without any intermission between, and afterwards to pass into a kind of continual Feaver. The condition of which, sometimes being very dangerous, with an evil affection of the Brain and nervous stock, so that oftentimes a Lethargy, or Delirium, or not seldom cramps, and Convulsive motions, were excited: About the month of *August*, this Feaver began to spread far and near, among the people, that in every Region and Village many were sick of it; but it was much more frequent in the Country, and smaller Villages, than in Cities or Towns. It was still like an intermitting Feaver, unless that it seemed more infectious than that is wont, and with more cruel fits, and shorter intermissions, and therefore was called

the new Disease: besides, it underwent the note of a certain malignity, and gave knowledg of its Contagion and Deadliness; insomuch, that it crept from house to house, infected with the same evil, most of the same Family, and especially those familiarly conversing with the sick; yea, old Men, and Men of ripe Age, it ordinarily took away.

If you respect the nature and essence of the Disease, this Feaver properly should be referred to the rank of intermitting Feavers, for the fits returned at set times, also for the most part they began with cold and shivering, and oftenest with vomiting, and by and by a most intense heat proceeding, they were finished at last with a sweat. The Urine in most appeared of a flame colour, thin in the fits, with some hypostasis, without it more thick, and with a redish sediment; altho with a most copious sweat, and often iterated, the Disease was not cured, which might be expected in a continual Feaver; yea, the distemper continued exceeding long, for many days, sometimes months, tho much evacuation almost daily hapned by vomit and sweat: which we observe frequently in an intermitting Feaver, rarely to happen in a continual; out of the fit, at any time of the Disease a purge was profitably instituted, which in a Synochus before the sign of concoction, were a wicked thing to attempt; besides, that this Feaver was of the intermitting kind, it seems to appear from hence, because very many recovered of it, that scarce one of a thousand died, which I scarce ever knew in an Epidemical Synochus. About the first beginnings of this Disease, it appeared very like to an intermitting Tertian, altho afterwards in some, by reason of the vicious provision of their body, and errors committed in Dyet, and sweating, it seemed to change into a continual; for in whom the fits were not rightly concluded, nor ended in a remission, by reason of the morbid matter not being thoroughly dispersed, their Blood was continually hot: from whence it came to pass, that the fits sooner returned, and continued longer; till at length, by reason of the plenty of matter, and the languishment of Nature, the Blood being made weaker, endeavoured no longer to swell up, and to separate the feaverish matter at set hours, but to subdue it by little and little, with a continual effervency.

We are to inquire concerning the causes of this Disease, what may be the leading, evident, and conjunct cause, viz. by the means of which it spread so generally, and became Epidemical through all *England*; by what means, and for what occasion, it was wont to be excited in all men: and lastly, what kind of alteration of the Blood and humors, being induced, brought forth this kind of Feaver, with such a provision of symptoms, and conserved it in the Act.

I know it is easie to place wholly the cause of this so popular Disease in the malignant constitution of the Air, to wit, that the Particles of the Air, in which we breath, were infected by a certain extraneous Infection, and not agreeable to our Nature, the little bodies of which Infections being admitted within, did ferment with the Blood and humors, and so in most, brought in this Feaver, almost with the same appearance of symptoms. For who dares deduce the original of a Disease so generally raging, from a less public fountain? or refer to any other place, the received causes of Diseases, than to that nest of Vital Air, on which every one feeds? But whilst I more attentively consider the thing, it seems to me, that its stem, and as it were its first beginnings, are to be sought a little deeper. To wit, that this Feaver is born not from the Contagion communicated by the Air, and immediately fixing its evil on men, but rather from a certain feaverish predisposition or nature, impressed some while before on our Bodies, because of the intemperance of the Year, which at length having gotten maturity, on the least occasion is brought into Act, and so breaks not forth into this Feaver, so much as it lifts it forth.

For when about the Calends of *July*, the Air was immoderately hot, with a most intense heat for many days, it easily altered our Blood towards an hot and bilous intemperance, by which (as in wine growing more hot than it should do) the sweet part, and the spirituous was much consumed, in the mean time, the Saline and Sulphureous was too much carried forth, that by that means, the Liquor easily contracted a rancor or sourness: We have in another place shewn, that this kind of disposition of the Blood, whereby indeed it turns from a sweet and spirituous temper, into a bilous or choleric, is most apt for intermitting Feavers: Hence the alible juice, which is continually carried into the mass of Blood, is not rightly concocted: nor assimilated into Blood, but perverted as it were into an extraneous and fermentative matter: which arising to a fulness in the bosom of the Blood it self, and growing
turgid

turgid according to its increase at set periods, as we have already shewn, induces the fits of the intermitting Feaver: when therefore, from the great burning heat of this Summer, the Blood almost of all men, becoming more hot than usual, was very much scorched, it is no wonder, if from thence it should contract a great aptitude for intermitting Feavers. But why not whilst the fervor of the Heaven was yet urgent; but a little after, this Disease spread it self, the reason is, because this indisposition is not impressed on our Blood at once, or at one time, but by little and little, and not but of a long time; and therefore, Diseases like Fruits, are chiefly ripened in Autumn, after the foregoing heat of the Summer.

This aptitude or feaverish disposition, all do not contract alike; those whose Blood is of a more hot Nature, and abounds more in Sulphur, and for that cause is sooner scorched, also such who labour, or stay long in the heat of the Sun, and open Air, by reason of their Blood being more remarkably torrifed, more easily fell into this Disease; wherefore, at first, it chiefly raged among Husbandmen in the Country: of these, who had acquired an aptitude to this Feaver, from the Blood being before scorched, some perhaps fell into this of their own accord, the feaverish disposition being leisurely carried forth to a maturity; others, by reason of a light occasion or evident cause, which was wont otherways to stir up the feaverish burning, as from taking Cold, Surfeit, drinking of Wine, and the like; and others fell sick from the Contagion received of others, for as the *effluvia* constantly came away from the sick, when they pierced Bodies predisposed to the like distemper, they easily excited the hid powers into Act.

As to the third Proposition, to wit, that the conjunct cause of this Disease, and its formal Reason, may be known, we must put you in mind of those things, which we have elsewhere delivered concerning the nature of intermitting Feavers; for we suppose the retorrid and bilous constitution of the Blood, as the basis of this Disease, by reason of which, the alible juice, being supplied daily, as it were in a certain measure, is not rightly concocted, but by the assation or scorching, becomes or goes into a fermentative matter, not miscible with the Blood. When the Blood is filled to a fullness with this matter (which happens at set intervals of times, because the alible juice is supplied as it were by a set measure) it of its own accord conceives a swelling up, and the growing hot or effervescency being excited, for the carrying away of this matter, causes the feaverish fit: which so long indures, till this feaverish matter being inkindled, and as it were burnt in the heart, is wholly dissipated with sweat.

From these things premised, it is made plain, that in this distemper, we now discourse of, there are some things happen by a peculiar way, from the common kind of intermitting Feavers, and therefore it was noted, and that not undeservedly, with the appellation of a New Feaver; which are, First, That about the beginning of the Disease, fits did a long while afflict the sick, without cold or shaking, but with a most intense heat, thirst, and cruel vomiting; by which, the sweat hardly, and for the most part partial, and often interrupted, succeeded, whereby the fit was not finished but of a long time. The reason of which, may be only laid upon the very choleric disposition of the Blood, and being above measure scorched: For this proceeding from the domineering Sulphur, wholly inhibits the wonted sourness of the Blood, which follows its turgency or swelling up, and is wont to stir up the cold or shivering; and by reason of this kind of temper of the Blood, too much roasting and as it were burning the alible juice, the Blood growing turgid, together with that juice, and being stirred up into motion, is inkindled more than it is wont in the heart, and by its deflagration, induces a most intense and troublesome heat, with thirst, to the sick. Cholerick vomitings, happen not only at the beginning, but in the middle of the fit, by reason of the abundance of choler, with which, the Choleduct Vessels being too much filled, infuse the intestines; which then, a Convulsion being stirred up, is easily emptied into the Ventricle: sweat hardly succeeds, because the bile abounds more than the serum, wherefore the feaverish matter being burnt, it is not easily fitted forth by sweat, but being either mingled with the Blood, causes the long effervency, or being carried towards the intestines, produces Vomiting, or a Flux. Secondly, This feaver differs from the vulgar intermitting Feaver, because after the fit was ended, there was no full intermission, even to a remission, but the sick still remained languishing and thirsty; and as to appetite, sleep, and other accidents, very ill: which indeed hapned, because, by the intense heat of the fit, more of the Blood and feaverish matter is inkindled, than that its recrements remaining after its deflagration, are able presently to be dissipated,

pated, especially, because the sweat, by reason of the dryness of the matter, very hardly succeeds, nor is the feaverish matter enough diluted with the serous *Latex*, to be sifted forth; wherefore, the Blood by its Contagion, in the time of the fit, not being perfectly freed, grows hot still, neither the fit being ended, doth it get any full truce from the Disease: In the mean time, whilst the Blood is urged after this manner, with almost a continual effervency, it differs from a Synochus; because in this, the Sulphureous part of the Blood, being too much carried forth, and as it were inflamed, causes the Feaver by its deflagration; but the continual ebullition, which after this manner comes upon this intermitting Feaver, wholly depends upon the confusion of the not miscible matter, and its hard secretion from the Blood. The Synochus happens like Wine growing hot of its own accord, by reason of its richness, the other conceives its fury, like the same Wine, by reason of some heterogeneous thing poured to it: wherefore we remark, that whilst our Feaver is seen still to be continual, it is not cured by sweat or the Flux of the Belly, altho they frequently and copiously happen: because it depending upon the Blood being depauperated, rather than being inflamed, it continues long, and disposes the sick towards a Cachexie,

3. There is a third reason of difference, by which this Feaver may be distinguished from the common rank of intermitting Feavers, and it is this, that it is easily propagated to others by Contagion; the reason of which is, because here very many bodies are predisposed after the same manner, towards the same distemper, which happens not at another time; wherefore, the meer effluvia from a diseased Body, are able to excite the like effect, in a very fit subject; even as some Beams of Flame enkindle Flame, in a very combustible matter: In the mean time all do not alike contract the Infection of this Feaver, but that some being less prepared or fitted for it, converse with the sick without harm.

4. There is another symptom occurs, not constant to this Feaver, but only happening in some places, that discriminates it not only from the common, but varies its own proper type; to wit, sometimes it happens, this Disease to be accompanied with a Dysenterick distemper; in some cholerick Vomits, and bilous Stools very much infect, and in others Bloody Stools follow, with cruel pains and torments of the Belly. The former I often observed in our Neighbourhood, and the reason of it may be deduced from the highly bilous temper of the Blood: For by reason of this, the adust matter, not to be dissipated by sweat, is copiously sifted into the Liver; then by reason of the choler-carrying Vessels, being filled to a flowing over, it is sent away to the Ventricle, and Intestines. The other Dysenterical distemper, was found only in some places, and there peculiar rather than common, it laid hold only of some sick. The origine of it may be referred to the peculiar dispositions of some Bodies, or vitious provision, also to the site of the place, or condition of the Air; then the Disease is to be suspected, to be thence translated to others, not without the communication of a certain Infection.

There is to be had a double Prognostication concerning this Disease: First, of the Feaver in General, what end it shall have, and when; what it may threaten to the Land: whether it precede not (which is commonly feared) the Plague, or Pestilential Sicknesses. Secondly, The signs ought to be laid down, whereby we are wont to presage health, or danger, in the various cases of the sick.

As to the First, Because we have shown that the Origine of this distemper is not to be fetched from the Contagion of the Air, or its being infected with any venomous Infection, nor from any malignant seeds of Vapours diffused through the Air, but only from the signal bilous temper or disposition of our Bodies, with the Blood being made adust and roasted extremely, by reason of the Summer heats, I think there is no reason of fear, that this Feaver should be carried forth into any thing worse, by the vice of the Air, or might at length grow to be Malignant or Pestilential. But rather (that the season of the Year being changed, and the alteration of our Blood assuredly to be expected) we might fear lest this Feaver, which now imitates the way of an intermitting Feaver, should afterwards pass into a Quartane, the Blood growing into a melancholy temper. Which thing indeed I observed to happen to some already, and I believe, that before the Autumn be fully passed over, will happen to many more.

As to the particular Prognostication, the chiefly notable signs, which occur in the course of this Feaver, and in a manner foretel its condition and event, are of this sort; if the Disease happens in a firm Body, well tempered, and easily perspirable; if

if vomiting with ease succeeds, and that the Belly be loose : if the fit begins with a light shivering, and afterwards a moderate heat, with sweat concludes it, and that the intermission be with some tolerable remission ; if the Pulse be strong, the Urine of a flame colour, clear, and with a laudable hypostasis, we may Predict that the Disease will quickly end without any danger. But if this Feaver be excited in a fat Body, and of a vitious habit, if with troublesome vomiting, an intolerable thirst, and fierce heat, long exercise the sick ; if to the heat a difficult sweat, and partial, and often interrupted, and between frequent vomitings succeed, and that it ends not in a remission, we may declare, that this Disease may be long, and of a dangerous issue. But if the sick remain in strength, and the Urine shew signs of concoction, we need not despair of health ; especially, if after four or five periods, the Disease, as it is wont to do, remits of its wonted fierceness. Thirdly we observe, if this Disease is excited in an old Body, or others broken with sicknesses, or debilitated ; if besides horrid vomitings, there happen swoonings, faintings, Deliriums or Lethargic distempers ; if after many fits, the sick having lost their strength, the Disease remits nothing, but exerciseth the Blood, with a continual effervency, and that the Vital Spirits are much destroyed ; if the appetite be lost, wakings pertinacious, and that they have Convulsive motions, with a weak Pulse, and Urine troubled, or thick, we judge the matter to be full of danger : yet is not the sick to be left as desperate, because the Disease is not hasty, and kills not suddenly, and out of hand ; but is drawn out at length, and grants time and occasions to nature, of recollecting her self, and to the Physician, of giving Remedies.

The Therapeutic Indications, which have place in the Cure of this Feaver, are chiefly four. First, That the Blood being now scorched, and made too choleric, may be reduced to its due temper. Secondly, That the depravation of the nourishable juice, and its alteration into a fermentative matter, may be inhibited, or at least lessened. Thirdly, That about the declining of the Disease, the Blood depauperated by a frequent deflagration, and made more impure by the fusion or pouring into it the morbidick or adust matter, may be restored, and rendered as it should be volatile. Fourthly, That the symptoms, which chiefly infest in the course of the Disease, may be timely helped, by fit Remedies ; that these intentions may be satisfied, I counsel that this following method be used.

About the beginning of the Disease, if the bilous or choleric humor, flowing forth of the choler bearing Vessels, and being suffused into the Ventricle, cause the sick to be prone to vomiting, let a more plentiful evacuation be procured, by a gentle Emetic in the time of the fit : The opening of a Vein, and Purging, ought not to be administered, unless between the fits : for whilst the Blood grows mainly hot, or is resolved into sweat, Nature ought not to be called back from the Work begun, nor her endeavours to be disturbed, by the prescriptions of Physicians ; wherefore, after the fit being past, and the sweat thoroughly finished, a Purging may be instituted, by a gentle Cathartic, and the same afterwards sometimes repeated, on the like occasion : for by this method, not only the provision of the excrementitious matter, is brought away, from the first passages, but chiefly the choler-bearing Vessels being emptied, the choler is copiously drawn forth from the mass of Blood, and by that means the Blood is restored to its natural Crasis or disposition. The Letting of Blood, if it be indicated, should be performed presently after the beginning ; for so its Liquor being too turgent or swelling up, is eventilated, whereby both the nutritious juice is less perverted, and the fit urging, it burns forth with a less heat, together with the morbidick matter : but otherwise, if a Vein be opened after a long sickness, when the Blood being made poorer, and more watry, more of the morbidick matter is heaped together, and does not rightly concoct, and sift it forth, it detracts much from the strength of Nature, and nothing from the power of the Disease. In the interval of the fits, when there is no place for opening a Vein, nor Purging, let the Belly be kept loose, by the constant use of Clysters ; also digestive Remedies, of acetous or saline Liquors and Powders, are to be exhibited ; of which sort are, Cream of Tartar, fixed Salts of Herbs, Tartar Vitriolate, Harts-horn burnt, Spirit of Vitriol, and Salt, &c. for these restore the lost, or sleepy ferments of the Viscera, purifie the Blood by fusing it, also separate the morbidick matter, and as it were precipitate it : also, at this time, between, if pertinacious waking infest the sick, and overthrow their strength, it may be lawful to administer anodyne, and gentle narcotic Remedies ; but never in the fit : for then they greatly hinder the subduing, and sifting forth of the feaverish matter, and draw out in length the fit that would end sooner. These

These things are to be done about the interstitia, or intervals of the fits; but whilst the fit is urgent, altho the sick then chiefly send for, and call upon Physicans, yet at this time their prescripts are limited to a narrower space: If Vomiting (notwithstanding an Emetic being given) still infest, it may be more freely provoked, either by simple Posset Drink, or with bitter Herbs boyled in it: But let the chiefest means of help be, in temperating the heat and thirst, which most grievously torments the sick in this Feaver: For whilst the Blood growing hot, with the morbid matter, and being inkindled in the Heart, leaps forth into the Lungs, stirs up there a cruel Inflammation, which requires a profusion of a cold humor as it were for the extinguishing the Flame; wherefore they greedily desire without any measure drink, for want of which the sick are almost killed with too great heat, and their Blood being almost wholly rarified into flame and fume, the thrud of Circulation is hardly continued; wherefore, drink ought to be wholly granted, to those in Feavers: which however, if it be taken in too large a quantity, it at first more disturbs the estuating Blood, and at length brings confusion to the feaverish matter, begun to be separated; that from thence, the Work of subaction and secretion is longer protacted, and the fit is made longer: also, besides, large drinking causes troubles in the Ventricle, and by disturbing it, and often provoking Vomiting, hinders the breathing forth, and calls inward the sweat breaking forth, or perhaps already broke forth: wherefore, at first, the heat of the Feaver being inkindled, altho the sick be very thirsty, let them only sip a little, and abstain from drink as much as they can; afterwards, when the matter being burnt, and subdued, begins to be dissipated by sweat, they may be more freely indulged as to this, for so the sweating is greatly helped, and the fit is sooner finished: as to the nature of the Drink, let them take sometimes Posset Drink, sometimes Small Beer, or Barly Water, and sometimes simple Water, or sharpened with the juice of Lemons: In this case, the use of Sal Prunellæ is deservedly praised, to be given in every Liquor; for this, with its nitrosity, wonderfully allays the raging Blood, and potently moves sweats, I have often observed, in the midst of a fit, the sick wont to fall into a swoon, or syncopy, to whom presently they give Cordials or hot Waters that much increase the violence of the Feaver, and bring forth more troubles than usual, that the fit is more difficultly finished: But these faintings, for the most part, happen, either from a bilous humor suffused in the Ventricle, or by reason of the sweat suddenly breaking forth; and against these I always found the most present Remedy, that either a feather being put down the throat, Vomiting may be provoked, or that Liquor being plentifully drunk, a sweat may be again raised up: also, in the whole course of this Feaver, I am wont never to give any Cordials, or alexiteriums.

The Dyet in this Feaver ought to be only slender, and not nourishing, all sorts of Flesh, or any thing prepared of them, are wholly to be avoided; for as these abound with Sulphur, they give a more plentiful food (as Oyl poured on Flame) to the hot or enkindled Blood: besides, nothing spiritous, as strong Waters, strong Beer, or Wine, is to be yielded to; but Decoctions, or Broths of Oat-meal, or Barly, altered with cooling Herbs, are chiefly to be used; also Posset Drink, and small Beer, or Whey, is to be given them at their pleasure: for by this means, when a very slender and watry nourishing juice, is conveyed to the mass of Blood, the soluted Particles of Sulphur, burn forth sooner, and with the less tumult; also the recrements of the adust matter, are more easily carried from the bosom of the Blood: but if on the contrary, a more rich or plentiful nourishment be administered, the effervency of the Blood is thereby very much augmented, and the Blood is more infected, by the confusion or pouring in of the adust matter.

After that the Blood being much burnt forth by frequent fits, and the Feaver being in its declination, remits of its fervor and fierceness, you must take heed, lest the sick at length growing well, fall not into a Cachexie, or Scorbutic Distemper: for the disposition of the Viscera being hurt, and the Blood very much depauperated, the alible juice, though not scorched so as at first, is not however rightly concocted, and ripened into perfect Blood: but by reason of the want of transpiration, the serous excrements, being imbued with a fixed salt, are greatly heaped together, and now fixed in the Bowels, now in the extreme parts, bring forth various Distempers. Wherefore in a long languishing of the sick, or otherwise for the sake of being sooner well, Remedies should be given them, which volatilise the Blood, or hinder the stuffings of the Viscera, or if stuffed, may open them, and their ferments as if extinct, restore: for this use, those Remedies and Preparations chiefly help, which are commonly

anonly called Digestives and Antiscorbuticks; with which being timely administred, I have known very many weak, pale, and as it were without Blood, suddenly to recover a liveliness and vigor.

The Description of a Catarrhal Feaver Epidemical in the middle of the Spring, in the Year 1658. taken the fourth of June.

AN equally intense Frost followed the next Winter, the immoderate heat of the foregoing Summer, so that no one living could remember such a Year, for either excess both of heat and cold. From the Ides of *December*, almost to the vernal Equinox, the Earth was covered with snow, and the North wind constantly blowing, all things without doors were frozen: also, afterwards, from the beginning of the Spring, almost to the beginning of *June*, the same Wind still blowing, the season was more like Winter than Spring; unless now and then a hot day came between. During the Winter (unless that a Quartan Feaver contracted in Autumn infested some) among our Countrymen, there was a moderate state of health, and freedom from all popular Diseases. The Spring coming on, an intermitting Tertian (as used to do every year before) fell upon some. About the end of *April*, suddenly a Distemper arose, as if sent by some blast of the Stars, which laid hold on very many together: that in some Towns, in the space of a Week, above a thousand people fell sick together. The particular symptom of this Disease, and which first invaded the sick, was a troublesome Cough, with great spitting, also a Catarrh falling down on the palat, throat, and nostrils; also it was accompanied with a feaverish Distemper, joyned with heat and thirst, want of appetite, a spontaneous weariness, and a grievous pain in the Back and Limbs: which Feaver however was more remiss in some, that they could go abroad, and follow their affairs in the time of their sickness, but complaining in the meantime, of want of strength, and of languishing, a loathing of food, a Cough, and a Catarrh: But in some a very hot Distemper plainly appeared, that being thrown into Bed they were troubled with burning, thirst, waking, hoarseness, and coughing, almost continual; sometimes there came upon this a bleeding at Nose, and in some a bloody spittle, and frequently a Bloody Flux, such as were indued with an infirm Body, or men of a more declining Age, that were taken with this Disease, not a few died of it; but the more strong, and almost all of an healthful constitution recovered: those who falling sick of this Disease, and died, for the most part died by reason of the strength being leisurely wasted, and a ferous heap more and more gathered together in the Breast, with the Feaver being increased, and a difficulty of breath, like those sick of an Hæctic Feaver. Concerning this Disease, we are to inquire, what procatartic cause it had; that it should arise in the middle of the Spring suddenly, and that the third part of Mankind almost, should be distempered with the same, in the space of a Month: then the signs and symptoms being carefully collated, the formal reason of this Disease, also its Crisis and way of Cure ought to be assigned.

That the Northern Wind is most apt to produce Catarrhs, besides the testimony of *Hippocrates* common experience doth make known: but why Catarrhs did not spread, at least in some peculiar places, all the Winter and Spring, but only in one months space, and then joyned with a Feaver, this Distemper should become Epidemical, doth not so plainly appear. I know many deduce the cause from the unequal temper of the Air, at that time; which altho for the most part very cold, yet the North Wind sometimes lessening, there would be a day or two very hot between: wherefore, from this occasion, as from cold taken after the heat, men should commonly fall sick: But indeed, for the exciting the Distemper, so suddenly rising, and commonly spreading, there is required, besides such an occasion, a great foregoing cause or predisposition, tho the other might suffice perhaps, for an evident cause, for to distemper them with this sickness; for we ought to suppose, that almost all men were prone to the receiving this Disease, otherwise no evident cause could have exercised its power so potently on so many, wherefore, it seems very likely, that this Disease had its Origine from the intemperance and great inordination of the year: and as the Autumnal intermitting Feaver before described, was the product of the preceding immoderate heat, so this Catarrhal Feaver, depended altogether upon the following part of the year, being so extremely cold: For the Blood being now thoroughly roasted by the very hot Summer, and prone to the Feaver before described,

then being made more sourish by the Autumn urging it, and apt for a Quartan Fever, afterwards being a little eventilated by reason of the strong cold of the Winter, and hindred from its due perspiration, retained yet its Dyscrasie, or evil disposition, and readily broke forth on the first occasion given: wherefore, when the Blood, in the middle of the Spring, (as the juice of Vegetables) being made more lively, and also begun to flower and grow rank, by reason of the stoppage being still continued, was straitned in its Circulation, and easily made prone to a feaverish effervescency: and as the serous Water redounding in the Blood, could not evaporate outwardly, because of the Pores being still straitned by the cold, restagnating within, and chiefly falling upon the Lungs, (where it might be moved about, instead of an outward breathing forth) excited the so frequent and troublesome Cough.

The Original therefore, and formal Reason of this Disease, are founded chiefly on two things, to wit, that there together hapned a greater effervescency of the Blood than usual, from the coming on of the Spring season, and also a stoppage, or great constriction of the Pores, excited by the too great cold of the foregoing season; that therefore there was not a free space granted to the Blood, flowing or luxuriating in the Vessels: The business being after the same manner, as if Wine begun to grow hot, should be put up into close shut Vessels, for by this means, either the Vessels, or the Liquor, were in danger to be lost.

Wherefore, that we may contract the thing in short, the cause that this Disease begun in the middle of the Spring, having presently spread largely, seized very many, was not the blast of a malignant Air, whereby the sick were distempered, as if struck with a blasting, but that at this time, the Blood being inspired by the constitution of the Spring, and so luxuriating, and apt to grow hot, was contracted or straitned in its motion, and, the effluvia being constrained inwardly, could not be sufficiently eventilated or cooled. In every year, tho' temperate, it is usual in the Spring and Autumn for some Epidemical Diseases to reign, because at this time, the Blood being as it were restored, flowers anew; and therefore, intermitting Feavers, and sometimes the Small Pox ordinarily spread in this season; wherefore, 'tis no wonder, after a great unequal constitution of the year, and not natural, when in this Spring, the Blood boiling up more lively within the Vessels, by reason of transpiration being hindred, could not be freely circulated, and sufficiently eventilated, if for that cause, great disorders follow, and from this most common cause, a distemper greatly Epidemical should be excited.

As to the symptoms joyned with this Disease, a feaverish intemperature, and whatsoever belongs to this, the heat of the *Præcordia*, thirst, a spontaneous weariness, pain in the Head, Loyns, and Limbs, were induced from the Blood growing hot, and not sufficiently eventilated: hence in many, a part of the thinner Blood being heated, and the rest of the Liquor being only driven into confusion, a simple Synochus, or of more days was induced, and this for the most part ceased within a few days: But in some endued with a vitious disposition of Blood, or evil habit of Body, this kind of Feaver, arising by reason of the same cause, quickly passed into a very dangerous Putrid Feaver, and often Mortal.

The Cough accompanying this Feaver with a Catarrh, draws its Origine from a serous humor heaped up together in the Blood, by reason of transpiration being hindred for a long time, and then an effervescency being risen, dropping forth more from the little Arteries, gaping within: for when the Pores are constrained, the superfluous serosities in the Blood, being wont to evaporate outwardly, are poured forth on the Lungs, by a proper castration or cleansing of the Blood, wherefore, by taking cold, (as they commonly term it) that is, from transpiration outwardly being hindred, the Cough for the most part is stirred up: And for a foregoing cause to this Distemper, the flowing forth of the serum into the mass of Blood, hath for the most part the chief place; for, from the long cold hindring the scorching of the Blood, or the provision of the bile, and prohibiting the breathing forth of the watry humor, there was a necessity, that very much of the serous humor should be heaped up in the Blood: wherefore, when the Blood flowing in the Spring, conceived an heat, the flowing forth of the serum, and a pouring of it on the interior parts, was wont to cause first the Cough, as the proper symptom of this Disease: and those, whose Blood was more diluted by the mixtion of the serum, and who were greatly obnoxious to the Cough and a Rheumatic Distemper, were cured with less trouble of the feaverish Distemper.

the Prognostick of this Disease, concerning private persons, is for the most part easie, that one may deliver the event, from the first assault; for if this sickness be excited in a strong Body, and healthful before, and that the feaverish Distemper be moderate, and without any grievous and horrid symptom, the business is free from danger, and the Distemper is to be accounted but of light moment, as that commonly is of catching cold, neither needs a Physician be consulted, nor Remedies, unless trivial and ordinary, be administered: But if this Distemper happens in a weak and sickly Body, with an evil provision, or that the Feaver being carried into a Putrid Feaver, or the Cough growing grievous, induces difficult breathing, and as it were a tabid or Consumptive disposition, the event of the Disease is much to be suspected, and often terminates in Death. The common Prognostic, that was taken from hence, concerning the future state of the year, contains nothing to be feared, or omimates any great ill; by reason of the unequal intemperance of the year, the great heats, and then excessive cold, we might fear Diseases to arise from the Dyscrasie of the Blood, yet from the present condition, we need neither suspect any noted depravation of the Air, or Infection with poysonous breaths; that from thence may be had any judgment of the Plague, or Malignant Disease to be at hand.

As to what belongs to the Cure, when this Disease is more lightly inflicted, its Cure for the most part is left to Nature: for this Feaver, when it is only a simple Synochus, is wont to be cured within a few days by sweat: wherefore, by a copious sweating, for the most part about the third or fourth day, the heat, and thirst, the weariness, and heavy pains are allayed; then the Cough being somewhat longer protracted, by little and little afterwards remits, and at length the sick leisurely grow well; if this Disease hath rooted it self more deeply, there is need of fit Remedies, and an exact method of curing, the Feaver growing worse is to be healed, according to the Rules to be observed in a Putrid Feaver: but nevertheless with this difference, that, because transpiration being hindred, and the suffusion of the serous humor on the Lungs, are chiefly in fault, therefore Diaphoretic Remedies, and those called pectoral are of more frequent use, for these restrain the flowing forth of the serum, from the Vessels within, or by opening the Pores convey it forth of doors; or precipitating it from the bosom of the Blood, send it forth by the urinary passages; therefore the method of Medicine for this Disease, being brought into the worse state, respects both the feaverish intemperance, for the sake of curing which you are to be directed, according to the intentions shewn in the Putrid Feaver, and also the Rheumatic Distemper, which however let it be secondary, and not every expectorating Remedy, or those used against a Cough are to be admitted, but of that kind only which do not increase the Feaver: the forms of these, and the means of curing, are to be sought from the precepts, delivered generally for the Cure of the Putrid Feaver, and of the Cough; the helps, which now, by frequent experience, are commonly said to bring Cure chiefly in this Disease, are sweating, or the provoking of sweat, and letting of Blood: for the Vessels being emptied by this or that means, both the immoderate heat of the Blood, and the abundance of the serum, are restrained.

A Description of an Epidemical Feaver arising about the beginning of Autumn 1658. taken the 13th of September.

THE vernal Feaver but now described, did not last longer than six weeks, that it plainly was seen, that it was only a more light flowing of the Blood, which swelling up in the Spring, and at the same time streightned in space, for want of ventilation, most impetuously boyled up, like new Wine close shut up in Bottles, and then ceased of it self. Yet from thence, as neither the year, so neither our Blood did recover its due temperature, and so another tinder or nest for a new Feaver, was quickly gathered together. Because after the Summer solstice, the North wind still blowing, a cold season remained for a long while; so that the Fruit and Corn this year, was feared by the Husbandmen, would scarce be thoroughly ripened; but after this, a little before the beginning of July, a most fierce heat followed, for several days: and when the Dog days were begun, the Air grew most cruelly hot, that one could scarce indure the open Air. By reason of this heat and cold in excess, the temperature of this year was very unequal: wherefore, there was a necessity, for our Blood to be now fixed, and as it were congealed, now too much roasted, and so perverted from its natural disposition, to a scorched, and melancholly temper; also it

came to pass that the Pores of the skin were much altered from their right constitution, that by that means, an insensible transpiration could not be performed, after the wonted manner.

From the time that the former Feaver ceased, almost to the end of the Dog days, there was a state of health, and free from all popular Diseases; but then a few here and there among the Villages, and in lesser places, first fell sick; but afterwards, about the end of *August*, a new Feaver suddenly arising, began to spread through whole Regions, every-where round about us; also, this as the other which spread the last Autumn, raged chiefly in Country Houses and Villages; but in the mean time, few of the Inhabitants of the greater Towns and Cities fell sick. At the same time, in other Regions, situate at a distance from us, yea, almost throughout *England*, the Epidemical Feaver was said to rage; and in some other places, to be far more deadly, than it was about our Country. Perhaps the Idea of this Feaver now reigning, had not the provision of its symptoms alike in all places, or was noted wholly with the same appearances and accidents: yet whatever it shewed in our parts, as to its nature, I shall briefly and succinctly add, from our own proper observation, or what I had learnt, being communicated from others.

About the beginning of this Disease, its figure was wandring, and very uncertain; because in some there was a continual fervor, in others it was intermitting, being renewed by set fits; but at this time it hapned to very many, as a pathognomic symptom, that they were ill in their brain, and nervous stock, that presently from the very beginning of this Feaver, almost all complained of their head being grievously distempered: For a cruel headach infested some, and hardness of hearing, with a noise in the ears troubled others, but to most was wont to happen, either a stupidity, and heavy sleepiness, with a vertiginous Distemper, or pertinacious wakings, with a delirium, and distractions of the animal spirits. I have observed in some, that on the first or second day of their sickness, that little broad and red spots, like to the measles, have leisurely broke forth in the whole body, which being shortly vanished, the Feaver presently became stronger, and especially the Distempers of the head, far more grievous. From thence a benumbedness of the senses, and a sleepiness fell upon some for many days, that they lay a long while as if dying, without speaking, or knowledge of their friends. I knew others to have fallen from hence into a Lethargy, and others cast into an Apoplexie, and some into a Phrensie, and Delirium. Of these, the younger, and strong men (yet not without a long languishment, and doubtful recovery) most of them escaped; in the mean time, old men, or other ways weak and sickly, generally died. Those who fell sick with the Feaver, as it were continual, with those notes of malignity, were more rare, and the distempered were only sporadically, in some houses only. But the sickness which most commonly spread about us, fell upon most, and tho it cruelly raged, it seemed to imitate an intermitting Feaver, to wit, either a Tertian, or a Quotidian: for that the sick had fits, either every day, or (which I more often observed) every other day, which infested them grievously, and a long while, with cold, heat, and sweat, succeeding in order: but these kind of fits, as also the course of the whole Disease, were wont to be noted with diversity, according to the age and temper of the sick; and with various course of symptoms, and accidents. Yet this was common to most of (I had like to have said all) the sick that together with the Feaver, they were troubled with Cephalic Distempers.

When therefore any one was troubled with this Disease, (whether the sickness was excited from an evident cause, or Contagion, or without any manifest occasion) its coming betrayed itself, by a pain in the head, and often in the loyns, with thirst, want of appetite, spontaneous weariness, and heat tho not strong: if it hapned in a young Body of a florid Blood, and more hot temper, the fits wanted the cold and shivering, about its beginning, but they were very troublesome, and sharp, with long heat: The sick were often troubled with vomiting, and their head ached cruelly for the most part; sweat difficulty succeeded, which being often partial and quickly broke off, rarely cured the fit, but when the sweat failed, they grew hot again, that scarce in 18 or 24 hours the fit was finished in some. In the mean time, from the Blood being very fervent, the phantasie was disturbed, that oftentimes a Delirium, absurd or idle talking, wakings, and high inquietudes were stirred up during the fit; but the same being finished, in the time between, still a troublesome thirst, a slow heat, languor of spirits, and great debility of strength, with an headach, and

a vertiginous Distemper, for the most part molested them. It was rarely found, for any to find themselves indifferently well, as in a common Tertian, between the fits. About the beginning of the Disease, the feaverish fiercenesses were somewhat more mild, which afterwards at every turn, leisurely grew worse, and then began with cold and shaking; to which nevertheless, after a long and very troublesome heat, sweat very hardly succeeded in most, so that the fit rarely ended in its due temper. Within six or seven periods, the strength of the sick was much cast down, that being made languid, and weak, they had an hard task to struggle with the Disease: because unless Nature were succoured by Art, the Feaver still prevailed, and rarely or never in a short time, was it cured by a Crisis, or leisurely remitted; but it brought the sick into great streights, by its long siege, and still persisting, till the Blood being by its frequent deflagration made very lifeless and watery, was unable to grow too hot in the Vessels of its own accord, or to be inkindled more plentifully in the heart, and then oftentimes, became so dead, and wanting of spirits, that, being insufficient for the continuing of the Vital Lamp, it brought in Death. But sometimes the mass of Blood being depraved, and made poor, by this Disease, was able (tho hardly) to continue the half extinct Vital Fire, and to renew it by little and little, with spirit and vigor, in a long time: yet in the mean time, after the height of this Disease, when the Blood being made more weak and impure, could not expel forth of doors this feaverish matter, or adust recrements, by a critical motion, it often transferred it to the Brain; and therefore about the height of this Feaver, a torpor, and stupidity of spirits, sleepiness, vertigo, tingling of the ears, tremblings, and convulsive motions, with a great oppression of the whole animal faculty, were most often induced.

Men of a more cold temperament, or in years, who were taken with this Disease, altho they were but little feaverish, were wont however to be in greater danger of Life; because, in these, besides the disposition of the Blood, not easily reducible, also what was gathered together in the fits, that was extraneous and not to be mixed, was hardly subdued, and difficultly sifted forth of the mass of Blood; wherefore, both the Blood was still more notably depraved in its Crasis, and in every fit more infected by the impure mixture: Moreover the nervous Liquor was greatly perverted from its due temper, and defiled most badly, by the adust recrements continually poured on the Brain. Therefore, when old men, melancholic, or otherways sickly persons, fell into this Feaver, they became, presently after its first assault, stupified, and for the most part vertiginous: Tho in the fits, the heat was not very sharp and piercing, they were however very unquiet, and still tossing about, oftentimes they talked idly, and at random; after a long burning, either no sweat, or only partial, and often broke off, followed; whereby the fit was not fully helped, but that in the whole intervals, the sick were thirsty, and remained very ill, with a dryness of the mouth, a scurfiness of the Tongue, and a suffusion of a viscous filth. After some fits, their strength being exceedingly cast down, they were wholly fixed to their Beds, or rise only for a little while, could scarce stand or set a foot before another, to move from place to place, or able to walk: in the mean time, they laboured with a languishment, a difficult breathing, a nummedness of senses, and a great debility of the whole nervous stock: The Urine in most was highly red, of a more deep colour, and of a thicker consistency, than in a common Tertian: The Pulse, whilst the strength was not wholly cast down, for the most part was strong and equal; afterwards, when the sick became very languishing, it was weak and unequal, and oftentimes intermitting; to which also, constrictures of the tendons, and convulsive motions in the wrists, being joyned, were for the most part prognosticks of Death. Those who leisurely being debilitated, declined towards Death, some little time before they died, lay for the most part without speaking, or knowing those about them, as it were stupid; and it rarely hapned in this Feaver, that any one about to die, was so perfect in their memory and intellect, as to dispose of their Family affairs, or to take leave of their friends. But it hapned to those who escaped, from a deep languishment and almost desperate condition, not quickly, or suddenly to recover, from their manifest evil disposition, but lying a long while wavering, stupified, and without strength, that Nature at length, not but after a doubtful and difficult strife, got indeed scarcely the better of the Disease, and then recovered strength by degrees, and health lingeringly and slowly.

If the nature, and formal reason of this Epidemical Feaver but now described, be demanded, we say, that this (as that of the former year) properly is an intermitting Feaver: for what commonly spread bore that figure; altho some here and there, more rarely, had it continual, which we shall by the way mention by and by. The seed plot or seminary of this, need not be derived from the air, being infected with any Infection, but rather its leading cause is to be sought, from the undue constitution of the year, and from thence an indisposition of our Blood being acquired. Because, in the Spring and Autumn, intermitting Feavers have yearly sprung up and increased; to wit, for that our Blood, like to the juice of Vegetables, is wont to be more lively moved than usual, and to flower at those times. Wherefore if the mass of Blood, by reason of the foregoing season, of the Summer, or Winter, should be altered from its due temperature, and should contract either a sharp or atrabilious disposition, or of any other kind, its evil dispositions begun before, are chiefly ripened about the Equinoxes; to wit, when the Blood more freely fermenting (if that it hath departed from its natural disposition) doth not so easily sanguifie, but that it will be apt to pervert the alible juice, poured to it, into an extraneous and feaverish matter. When therefore this year, had not very much declined from a right constitution, (as not only the Dog-days going before but) that the two solstices, and the equinoxes, were wholly intemperate, it was no wonder if intermitting Feavers, more frequent than usual, and those noted with some unusual symptoms, did increase about the Autumn. That therefore an intermitting Epidemical Feaver raged at this time, I judge it not to be attributed to the fault of the present Air, but to the irregularities of the foregoing season: yet from what causes and occasions, some symptoms proper to this Feaver, and distinct from the common rule of intermitting Feavers, did arise, will be worth our Inquiry. I have already said, that the provision, that made this Feaver so deadly, consisted in two things, chiefly, *viz.* the temper of the year, now extremely cold, then upon it very hot, then that it had variously perverted the disposition of our Blood, and had distempered the pores of the skin, with an undue constitution. According to the reasons taken from either, I shall endeavour to explicate the accidents of this Disease, and to assign the causes of its appearance.

1. First, We shall observe, that the type of this Feaver was various, to wit, in some with a continual heat, in others with an eruption of spots, but in most intermitting, and like a Tertian, and sometimes (tho rarely) a Quotidian, repeating the fits every day, or every other day: the cause of this diversity, we impute to the more strong and potent morbid procacitay of this year, which produced in the Autumn, a more common intermitting Feaver than it was wont, wherefore, in some (perhaps indued with a more proved habit of Body) it stirred up Feavers something malignant; and in whom it caused intermitting Feavers, according to the wonted manner of the season, it made them to be noted with a peculiar appearance of symptoms.

2. Those taken at this time, with the Epidemical Feaver (whether it was continual or intermitting) suffered presently evil Distempers of the head, *viz.* now they were wont to be infected with cruel head-ach, now with a stupor, or too great distraction of the Animal Spirits. The reason of this is, that the nervous juice, as well as the Blood, by reason of the intemperance of the year, was much altered from its due Crasis or Disposition, *viz.* by nature sweet and spirituous, and was become now heavy, and almost lifeless, now sharp, and too much pungitive. Besides, also, the mass itself of the Blood, very much contributed to this evil; for whilst it grew hot, the vaporous effluvia, which ought to have been dispersed outwardly, by reason of the Pores being shut up, were poured upon the Brain, and membranes of the head: and by reason of this kind of stopping, impressed almost on all, sweat hardly, and not but partial, and often interrupted, succeeded in the fits; hence also in the height of the Disease, a perfect Crisis, or spontaneous, rarely or never hapned to Cure it; but instead of this, if the business was committed to Nature, the adust matter, or recrements gathered together in the Blood, were transferred to the head, and there raised up now the sleepy evil, now Phrensies, and those long and stubborn.

3. That the fits sometimes begun without cold or shivering, but with a troublesome heat, and were prolonged with a difficult sweat, partial, and often interrupted

rupted; then forasmuch as the same being finished, the sick began again to wax hot, that the fits were not finished without a long evaporation of a dry breath; the cause was, the too sharp and bilious disposition of the Blood, whereby when it grew turgid, it was stuffed rather with adust Salt and Sulphur, than a serous juice, and presently conceived an inkindling, without any previous Flux of nitrous matter; and therefore for want of serum, and by reason of the Pores being shut up, its deflagration was continued for a long time, almost only with a dry exhalation, and scarce at last ended in a remission. And therefore the intersticia of the fits were most troublesome with heat, and thirst, Head-ach, Vertigo, and other Distempers: because the feaverish matter, being heaped up in the Blood, was not all dispersed by the several fits, but part of it being left after the fit, as it were extraneous and not miscible, induced almost a continual burning.

4. It was observed, that those distempered with this Feaver, presently lost their strength and flesh, that after a fit or two, they panted for breath, and being very weak, were not able to stand or go, without being led; when it is an usual thing, in an intermitting Feaver that is common, for the Patient to be very lively and cheerful, between the fits: the reason of the difference is, because in this Feaver, the mass of the Blood is both more depraved by the impure mixture of the degenerate juice, and especially, that the same is more perverted from its natural disposition, and therefore, when it boils up less out of the fits, it yet ferments not rightly, and equally in the bosom of the heart: wherefore, when by any more quick motion, or agitation of the Body, the Blood is carried more impetuously into the bosom of the heart, because it is not there presently inkindled, it both leaps forth of doors, and by its stagnation, causes the oppression of the heart, and great weakning of the Vital Spirits. By reason of this kind of dyscrasie of the Blood, to wit, whereby it is made more unfit for due Fermentation and inkindling in the heart, also some Beasts, and especially Horses, in the Spring time, are made hard breathed, and very unapt to any rapid motion.

5. Lastly, We are to inquire, concerning this Feaver, wherefore it spread chiefly in Villages, in lesser Towns, and the Country, when Cities and greater Towns were less troubled with it. It might seem that this Distemper, should be excited from marshie Fogs, and other hurtful Vapours, plentifully heaped together in this or that Tract of the Air: but there is a better reason, for that the inhabitants of these kind of places, being more exposed to the Spring cold, and then to the Summer heats, might have contracted a greater Dyscrasie of the Blood, and so a more apt disposition to this Feaver. For in truth, the Inhabitants of the Country, could scarce go out of their houses, but they were exposed to the Sun's Beams, or the fervor of the heated Air. Besides, Countrymen, Husbandmen, and such as were accustomed to Labours (among whom this Feaver chiefly raged) from their immoderate toyl in the Sun, or open Air, also using a bad and sharp Dyet, sooner acquired an adust and torrid disposition of the Blood, and so more apt for this Disease, than Citizens and Townsmen, who lived an idle life, and enjoyed wholesome food, and mostly continued within doors, and in refrigerating shades. We may believe this assertion, for that not only the Epidemical Feaver now raging, but also another of the Autumn before, excited by reason of the evil disposition of the Blood, increased chiefly among the Countrymen, and inhabitants of the Country: but the popular Feaver, which arose in the middle of the Spring, depending chiefly upon transpiration being hindered, mostly infested Citizens and the Inhabitants of Towns; whilst rustical men, that were wont, by Labour and Exercise, to procure a more free breathing forth, remained free.

The general Prognostication of this Disease, seems only to ominate or foretel, the like evil almost to follow this, as followed the Epidemical Feaver of the former Autumn, to wit, (the Augury being taken rather from the intemperance of our Blood, than from the evil of the Air) not the Pest, but a Quarantine Feaver might be feared to come upon it. As to the particular Indication, as Signs that promise Health or Death, I shall briefly mention them; and they chiefly respect the temper and government, either of the Blood, with the Vital Spirit,

Spirit, or else of the nervous juice, with the animal Spirit. If it be plainly indicated from the Pulse, Urine, from Actions less hurt, and the appearance of other symptoms, that the Blood, as to its feaverish disposition, is not very much perverted, from its natural temper; that in the fits it moderately burns forth; and in every Combat easily subdues the load of the feaverish matter, and wholly shakes it off from its company; that after some fits, the mass of Blood is somewhat restored towards its due temper; that it perverts little the alible juice, and lifts forth, with a more gentle rising up, what is extraneous, and not mingleable, and that if in the mean time, the other spirituous Liquor, rightly inspires and waters the Brain, and nervous Bodies, that sleep, waking, sensation, and motion, are performed well, or at least indifferently, all good is to be hoped concerning the sick. But if it appears from the same Fountains of Indications, that the Blood hath acquired in this Feaver, a disposition far removed from the natural, if it perverts much of the alible juice, and then from its extraneous and incongruous mixture, the Liquor of the Blood is greatly disturbed, and the Spirits driven into confusion; if in the fits, the Blood too strongly, and in a long time burns forth, yet doth not truly subdue the feaverish matter, or exclude the whole, but that by its impure mixture, it is still more and (in every feaverish fit) more infected, and the Spirits being continually consumed, it becomes poorer, we may pronounce the life of the patient to be in much danger. Besides these, if the vices of the nervous juice happen, that being altered from its due temper, or being too dull, and as it were lifeless, little actuates the Brain and nervous stock; or being above measure sharp, continually provokes the same into Convulsions and Distractions; and if besides the vaporous effluvia continually falling away from the Blood, or the adust recrements being wont to be sifted forth by a critical sweat, should be transferred into the head, and there induce Lethargic or Phrenical Distempers, the hopes of health will be little, and we may fear a very deadly event.

Concerning the Cure of this Disease, the intentions will come under three considerations chiefly. First, a quick reduction (as much as may be) of the Blood, and nervous Liquor, to their natural tempers, or at least a prevention of their too great depravation. Secondly, Concerning the right handling the fits of the sick it ought to be procured, First, that less of the degenerate juice, may be gathered together, for matter of the fit; Secondly, that what is gathered together may be wholly dispersed by every fit, that thereby the sick may be better in the intervals; Thirdly, that the Body being altered for the better the fits may be inhibited by anti-feaverish Remedies. The third intention respects the symptoms chiefly urging, which should be timely opposed, whereby Nature, being not hindred, may reduce whatsoever intemperance may be contained in the Viscera, or Vessels, may subdue and sift forth the extraneous matter, and at length may recover a lively force and pristine vigor.

First, therefore, for the reduction and emendation of the Blood and nervous juice, diverse manners of evacuations are wont to be exhibited in this Disease, about the beginning of the Sicknels, with good success. It appears plainly from Modern practice, that vomitories are of more noted use in this Distemper, than in a common Tertian: wherefore in a robust Body, and prone to Vomit, about the beginning of the second or third fit, it is convenient to give an Emetic Medicine. The operation of this seems to be very helpful in this Feaver, forasmuch as it more plentifully evacuates the filth from the ventricle, and the yellow bile from the choler-bearing Vessels; and because it copiously presses forth the serous juice from the emunctories of the nervous stock, planted about the Pancreas and Intestines, and by provoking them draws it out. Wherefore we observe, that from a Vomit being taken, the sick do find themselves better about the Distempers of the Head. A Purge (to whom a Vomit is not convenient) may be ordered instead of it, the day following the fit, also tho an Emetic have been taken, it may be well permitted after a fit or two: But yet only with gentle and benign Physic, let it be performed, which will not disturb or too much move the Blood. We were wont in these Feavers, letting alone Diagridium or any Aloetic Medicine, only to give an infusion or Powder of Senna, Rhabarb, and yellow Sanders, with Tartar and Salt of Wormwood; and to celebrate

celebrate this kind of Purgation not very long after the beginning of the Disease: But at other times to keep the Belly soluble, with the frequent use of Clysters. Frequent experience has sufficiently taught, that Letting of Blood is highly profitable in this Disease: for when by reason of the Pores in every one, being more strictly closed than usual, the Blood growing hot, by the Feaver, wanted Ventilation, the Letting of Blood supplies the place of a more free breathing forth, and prevents the restrained *effluvia*, from so readily suffusing themselves on the Brain and nervous stock. But this Remedy is chiefly indicated from the very fervent Blood, and more hot temperament, nor ought to be indifferently used to old men, Phlegmatic, and other very weak persons, unless perhaps in a small quantity, that the mass of Blood may be somewhat eventilated, and that the removal of the feaverish matter into the Brain, may be hindered. If it be convenient to open a Vein, let it be done about the beginning of the Feaver, or at least before the fourth or fifth fit, *viz.* before the Blood is made very lifeless by the frequent deflagration, and rendered too impure by the confusion of the adust matter: because, if Phlebotomy be made use of, whilst the Blood is highly corrupted, the Vital Spirits, and by that means the strength of the sick are more debilitated, nor yet is there any thing taken away, from the power of the Disease, or from its cause. There remains another famous way of evacuation, in this Feaver, to wit, Vesicatory Plaisters applied to various parts of the Body; these are commonly observed to be so helpful, that those that abhor and dislike very much such a Remedy, by the example of others being the better for them, have admitted them. By what means they separate the Cuticula from the skin, and lift it up like a Bladder filled with Water; or whether they press forth this watery and limpid humor, out of the Arteries, or out of the nerves, is not in this place to be inquired into; yet that they are profitably administered in this Disease, besides experience, Reason seems something to persuade; because it in some manner compensates the want of transpiration, by the large profusion of this kind of serous Latex: Moreover, this kind of Remedy, as it were opens the ways and doors, by which both the Blood, and nervous juice, may forthwith send forth by a proper purging, the extraneous matter, confused with them; wherefore, in the Plague, and Malignant Distempers, Vesicatories are esteemed very profitable. Also it appears by common observation, that in this, and other Feavers, frequent at the same time, they did prevent the more grievous Distempers of the Head, and were wont to help them, if they were brought in before: wherefore, epispastic Plaisters, may be applied about the beginning of the Disease, for preservation sake, to Phlegmatic persons, elderly people, and men of a more cold temper; and they are wont profitably to be administered to several others, labouring with a Vertigo, Stupor, or cruel Head-ach, for the Cure of the same Distempers. But in constitutions very hot; where with the defect of the serum, the Blood is too much burnt, and if those sick of the Feaver are obnoxious to wakings, or a Phrensie, with intolerable heat, blisterings seem then to be of little use.

For the mending of the temper of the Blood, and also the tenor of the Viscera, at vacant times, when there is leisure from purging, attemperating Remedies have place, and digestives, which fuse the Liquor of the Blood, and separate its scæculencies, and as it were by precipitating them, thrust them towards the emunctuaries: For these sort of intentions, are wont to be given Juleps, and refrigerating Decoctions, sharpened with spirit of Vitriol, of Salt, Tamarinds, or with the juice of Oranges or Lemons; forms of which choice enough are commonly to be had. Also for this end acetous, saline, and shelly Powders are used, to wit, prepared out of Tartar, Salnitre, the fixed Salt of Herbs, of burnt Harts-horn, also the claws and eyes of Crabs. As for example, take of Cream of Tartar drams three, of Salt of Wormwood dram one and an half; the Dose half a dram, in an opening Decoction, twice in a day out of the fit. Or take of Cream of Tartar dram one, of the Powder of Crabs eyes dram one, of purified Nitre half a dram, mingle them, let them be taken after the same manner. Or take of Harts-horn burnt drams two, of the Spirit of Vitriol, what the Powder will drink up, the Dose is one scruple, it is of excellent use when those in Feavers are infested with Worms. These kind of Remedies, promote the secretion of the feaverish matter, and also restore the almost destroyed ferments of the Blood, and Viscera.

The second intention, *viz.* concerning the right handling the fits, comprehends more. First, there ought to be instituted a right order of Dyet, whereby the more full heaping up of the degenerate juice, for the matter of the fit, may be inhibited; wherefore, they are only to be fed with thin aliments, and they must wholly abstain from flesh, (or broth made of it) Eggs, strong Drink, and all rich meats and food whatsoever; and be contented only with Barly Broth, or Grewel, Panada, Whey, and small Beer: for that a more plentiful aliment is not digested, or assimilated, but loads the Ventricle, and being poured into the Blood, disturbs its Liquor, and compels it to grow impetuously hot. In the beginning of the fit, and the time of its duration, no food should be taken, unless for the allaying of thirst: But for the tempering of heat and thirst, Juleps, and cooling Decoctions, and especially small Beer, and posset Drink should be granted. Secondly, a little before the coming of the fit is expected, a gentle Medicine may be administered, which may drive away the fit by preventing it, or make it more easie by procuring a sweat: for this use, the febrifuge potion of the most learned *Riverius* serves well, of the Water of Carduus, with oyl of Sulphur, and salt of Wormwood: Or take of Cream of Tartar, of salt of Wormwood, and the seeds of Nettles, each one scruple, let it be given in the Decoction of the Roots of Sorrel; when the Feaver begins to decline, and that the fits are a little more remiss, proper febrifuges, applied outwardly, often inhibit the comings of the fits. Yet in the mean time, so long as the fits of the Feaver return, the sick are to be handled so, that in every fit, the feaverish matter heaped in the Blood, may be thoroughly dispersed; wherefore, when sweat hardly succeeds, it should be a little excited by temperate Medicines. Also the sick should be kept in bed, with a gentle breathing many hours, nor quickly permitted to rise; for I have often observed, that sick persons have been still worse, because impatient of their bed, they have put on their cloaths before the vaporous effluvia were sufficiently exhaled.

Thirdly, as to the symptoms, and particular accidents, wherewith the sick are wont to be infested in this Feaver, it is sufficiently provided for most of them, with Remedies, in the method of Cure hitherto described: again thirst, the heat of the mouth, the scurfiness of the tongue, vomiting, the looseness, fainting, swooning, may be referred hither, very well the prescriptions commonly used in other Feavers: but what may seem to require in this Disease a peculiar method of healing, are chiefly the Distempers of the head and brain, with the nervous stock, which not being timely helped, may soon put the sick into great danger of life: As to the indications of these kind of evils of the head, they are of a twofold kind; if it appears from a stupefaction or torpor, a Sleepiness, Vertigo, or Head-ach, that the nervous juice is become too dull, and as it were vapid or lifeless, and therefore doth not sufficiently actuate the brain, and nervous bodies; besides the Remedies already delivered, and especially vesicatories, Medicines full of a volatile salt do chiefly help: wherefore, spirits of Harts-horn, and of Blood, also the salts of them, are of excellent use: but if the nervous Liquor be too sharp, or the effluvia suffused from the estuating Blood, drive the Animal Spirits into confusions or distractions, Remedies of the same sort of volatile salt are administered with success in a little smaller quantity. Besides, a frequent letting of Blood, and asswaging Medicines, against its Fervor, help much; as Emulsions, Whey, and simple Water, plentifully drunk; Opiats are cautiously to be given in this Feaver, for the Phrensie being often allayed by them, is changed into a Lethargie, or a deep stupefaction.

F I N I S.

FIVE TREATISES,

V I Z.

- 1. *Of Urines.*
- 2. *Of the Accension of the Blood.*
- 3. *Of Musculary Motion.*
- 4. *The Anatomy of the Brain.*
- 5. *The Description and use of the Nerves.*

BY

THOMAS WILLIS, M.D.



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THE
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EPISTLE
TO
Dr BATHURST.

Worthy Sir,

THE Inspection of Urines, and from them an investigation of directions concerning the Medicinal practice, began to be esteemed among the Ancients, even from the first beginning of Medicine: for from hence for the making of judgments concerning the Sick, and for the chusing the most fit times for Curing, the great Hippocrates hath chiefly taken both his prænotions, and his precepts, so that that famous and to this day approved statute of old Medicine, to wit, τὰ πένονα φαρμακεύειν, to compose Medicine according to digestions, cannot be observed without rightly consulting the Urinal. Also this seems consonant to common reason, that for as much as we cannot search into the most intimate parts of the sick Body, as it were a Vessel shut up, judgment is sought from the infused liquor, washing all its parts, and taking from many some little parcels. For neither more certainly do the acidulous or Spaw-waters, shew the nature of the hidden Mine, through which they are strained, than Urines give testimony of the divers manners of dyscrasies of our Bodies, and their habitudes. Wherefore the Contemplation of this Excrement, (as vile as it is) hath grown to a Science, and hath exercised the ingenuities of the most excellent Physicians, both Ancient and Modern. Concerning this thing there are many Books extant, writ with great diligence; in which are rehearsed the great differences of Urines, varieties of Colours, and diversities of Consistence, and their Contents exactly described, and distinct precepts are delivered for every excretion of them: Which indeed are esteemed by some of so great certitude, that from the inspection of the water, a signification is sought of any Disease, or of the part affected; yea of every accident concerning the sick. But in this the common people are egregiously deceived, and still pertinaciously will be deceived, whilst they imagine the knowledg of every Disease, and the prognostication of it cannot be found out, but by inspecting the Urine; and esteem a Physician of little worth unless he undertakes to divine from the Urinal as from a Magical Glass. But indeed, as to what belongs to the precepts, and rules, whereon the reason of Judgment by Urine doth depend; there are many collected by diligent observation, that are extant, and from thence establish'd with good reason and judgment: yet for as much as the signification of Urines is by some too largely extended to particular Cases, very many uncertain things interwoven, and some obnoxious to deceit, and others plainly false; therefore who shall confidently pronounce concerning the business of the Sick, by the judgment only of the Water, deserves rather the name of a juggling Quack, than of a Physician.

But this Doctrine concerning Urines, abounds so ordinarily with errors, that the observations which belong to its practice, are either wrongfully made, or not well reduced into method. We may lawfully suspect that the observations are not rightly made, because, perhaps from one or two particular cases, oftentimes a general Rule is established. For Example sake, because some Hydro-pical people render a thin and watery Urine, therefore it is affirmed, such sort of Urines necessarily denote a Dropsie, when also in some other diseases, such like Urines are made; and sometimes in the Dropsie, the Urine are thick, and full of redness. Also as it is most commonly received, that Urines on which a cream doth swim (as on water that hath Tartar boyled in it) doth denote a Consumption, which is most uncertain, because this sign is more proper and familiar to Hypochondriacks, than to Consumptive people: And how many dye of Consumptions without this? Besides, what is generally asserted, to wit, that in all diseases whatsoever, Nature doth make known the Disease by the Urine, is altogether false; because sometimes sick people make their Urine like healthful people; and sometimes those who are very well in health, by reason of some accident (perhaps from the meats eaten) have suspected Urine, varying from the natural state or condition. As to what belongs to the method, or doctrine delivered by most, concerning Urines, they seem to be altogether Empirical, and nothing rational: for the naked differences of Urines are rehearsed, and are wont to be distinguished according to their colour, consistency, and contents: thence are opposed to the several species of these pathologicke significations, collected only from more rare observations; when in the mean time, the causes of the appearances, nor of the preternatural alterations in the Urines, are not assigned, as they ought to be; nor is the signification of the Urines applied to the Causes of diseases, but only to the Disease or Symptom; and therefore it is most often deceitful, and uncertain; because the same morbidick Cause, and signification of the same Urine, may in like manner mediate respect at once divers Diseases, and Symptoms. As for Example, a thin and watry Urine most often immediately denotes Indigestion, or a defect of Concoction in the Viscera: nevertheless, by reason of that condition of Crudity, the Green-sickness in Virgins, sometimes the Dropsie, or the white watery phlegmacy, sometimes Head-aches, and many other diseases arise. But the task which you have required of me, Worthy Sir, to wit, That the notions which in times past we have discoursed together, and conceived concerning Urines, as it were collected notes, and what have since fallen under my own knowledg, by my proper study and observation, concerning this thing, should be fram'd into a little Treatise, and that I should write a plain, and new method of Urinoscopie. I confess the work greater than can well be performed by our own proper strength: however, I have resolved as much as I am able, to obey you therein. But that a doctrine or method concerning Urines may be instituted, beyond the vulgar and plainly Empirical manner of Philosophising, there shall be these two heads of our Discourse. To wit, First that the Anatomy of Urine may be delivered, of what elements and parts it consists; and also its genesis in our Body; to wit, by what Concoction this kind of Liquor is made, and then by what secretion of some Particles from others. Secondly, That the inspection of urines in the Urinal may be truly unfolded, and what may be the Rules, and the Certitude of Uromancie, or divination of the Urine.

OF URINES.

CHAP. I.

Of the Elements and chief Accidents of Urine.

WHEN the Liquor of the Urine, being either fresh rendred from the body, or putrified by a long digestion, is exposed to a spagirick Analysis, it is wont to be resolved into these parts or principles: In the Distilling, first, ascends whatever of a vinous spirit is in it, diluted with water; but yet in so very small quantity, that it is not easily to be perceived by the taste it self.

To this follows a watry liquor, large enough in proportion, with which are mixed some more loose particles of Salt, and Sulphur especially. Thirdly, There is stilled forth a very penetrative water; which is commonly called the spirit of Urine, but in truth almost without any vinous spirit, and is chiefly phlegm highly sharpned with Salt, and therefore it ascends last, as in the distillation of Vinegar: but forasmuch as the salt of Urine is volatile, but that of Vinegar only in the Flux; therefore the liquor stilled forth, which is greatly impregnated with its particles, is very acid: That which is imbued with the saline Particles of the other, is exceeding sharp and pricking. It is a sign that this kind of Spirit of Urine (as it is commonly known) owes its sharpness chiefly to the Salt; because, though it be most subtil it will not take fire, but being put to it extinguishes it. After the humidity is wholly exhal'd, another portion of Salt remains with the earth, in the bottom of the cucurbit; to which if a more hot fire be made, that Salt will be sublimed into the Alembick, and the earthy feces only remain. This kind of Anatomy of Urine plainly shows, that the Elements of which its liquor is composed, are a great deal of Water and Salt, and a little of Sulphur and Earth, and a very little of Spirit.

The saltness in Urines is perceived by the taste and touch; it comes nearest to a Nitrous salt in favour: It is drawn indeed from saline particles of things eaten, which being more plentifully exalted by the concoction in the Bowels, and the circulation in the Vessels, for the most part go into a volatile Salt. That is truly Salt and Spirit, by reason of the long accompanying of either together, are gathered into a most strict bond; and therefore it happens, that the Salt it self otherways fixed, is carried up on high, and rendred able for motion, as it were by the wings of the other. Urines contain in them more or less of Salt, according to the disposition of our body, and have it either more volatile or fixed; which are therefore of a divers colour and consistency.

That there is Sulphur contained in Urines, their quickly putrifying, and stink, sufficiently testifie: it arises from the fat and sulphureous particles of Meats, in the concoction being most minutely broken, and boyl'd with the serum and salt; so as also there is less plenty of Spirit in it, than is in Blood, Soot, or the Horns of Animals: wherefore in the distillation of Urine, there ascends nothing almost of an oylie form or fat. But indeed, whilst the blood is circulated in the Vessels, the spirituous and sulphureous little bodies, which fall away from it, do for the most part evaporate out of doors; in the mean time, the saline recrements, and the watery, chiefly constitute the Piss: nevertheless, Urines do always participate a little of sulphur, but its quantity and proportion, is diversly altered according to the various degrees of Concoction and Crudity; and thence also the colour and consistence receive many mutations in Urines.

That there is but a very little of vinous spirit in Urines, the defect of it in the liquor first distilled forth, also the soon putrifying of the Stale do testifie: but that there is some, the intestine motion of the particles in the Urine, doth argue, to wit, the departure of the thin from the thick, and the spontaneous separation of some parts from others, and a collection of them into a settlement: besides, the saline particles (for that they are made volatile) are married to spirituals, and so they are of a more ready motion, and energy; yet according to the divers plenty of spirits in Urines, and their power, there arise divers manners of hypostases and settlements; also the Urines themselves, sooner or slower putrifie.

The watry part of the Urine far exceeds the rest in quantity, and is greater than they by almost a sixth part: it is not so simply drawn forth by distillation, but that some particles of Salt and Sulphur (for as much as they are volatile) ascend with it, and impart to the water an ingrateful stink: the potent matter, copiously taken with aliments, affords an original to this; which of what kind soever it be, before it is changed into Urine, lays aside its proper qualities, and acquires others; for truly, from the assumed liquor, there is nothing sincere almost left in the Piss, besides meer humidity.

That there is earth, and muddy feces to be had in Urines, its distillation, or evaporation sufficiently declares: for when the rest of the parts are exhaled, the earth as it were a *caput mortuum*, will remain in a moderate quantity in the bottom: Forasmuch as in the nourishing juice, there is required something solid besides the active principles of salt, sulphur, and spirit, whence the bulk and magnitude of the body grows; the recrements of this, *viz.* the earthy feculencies, are plentifully dissolved in the serum, and contribute to it a thick consistence and contents: but these shew themselves after a divers manner, according to the state of Concoction and Crudity.

These are the principles which constitute the body of the Urine, also into which it is easily resolved, by a Chymical Analysis: Out of the divers changes, and various temperation of these, the other accidents of Urine arise, *viz.* Quantity, Colour, Consistency, and Contents, which are as to the sense the most notable concerning it, and the chief objects of the rendred Urine: For when there is nothing almost beheld besides in the Piss, they constitute these first Phænomena, in which rightly solved, consists the whole Hypothesis of this Science: Wherefore we shall speak in the next place concerning these, and first of the Urine of healthful people, what its quantity may be, how coloured, with what consistence and contents indued; and together shall be unfolded, out of what mixture of Elements, and by what Concoction in the *Viscera*, and Vessels, each of these depend. Secondly, shall be shown how many ways the Urines of Sick people vary from the square or Rule of this of the Sound: and I shall endeavour to assign, for the several differences of them, proper Causes of their alterations; and these shall conclude our first proposition in this Discourse, *viz.* the Anatomy of Urine.

CHAP. II.

Of the Quantity and Colour of the Urines of Sound People.

THE Quantity of the Urine in sound people ought to be a little less than the humor, or liquid substance daily taken; for moist and drinkable things daily taken, are the matter it self of which Urines are first made: But these (hunger and thirst urging) are more plentifully required, both that they may sufficiently wash the mass of the Chyme, by which means it may rightly ferment in the Viscera; and that they may serve for a Vehicle, both to the Chyme, whereby it may be conveyed to the bloody Mass, and to the Blood it self, that it might be circulated in the Vessels without thickening; and to the Nervous Juice, whereby it might actuate and water the Organs of sense and motion: when the serous Latex by this means hath bestowed whatever it hath almost of Spirit and Sulphur, for nourishment, Heat, and Motion, it gives way to a new nutritious humor; and it self as unprofitable, being secluded from the Blood, by the help of the Reins is sent away.

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The nourishing liquor, which will at last be changed into Urine, of its own nature is divers, *viz.* now watry, now impregnated with Spirit, now with Salt and Sulphur, and according to the various forces of this or that Element in it Urines are wont to be somewhat altered: However all liquors taken in at the mouth, do not pass thorow our body whole and untouched; but that they undergo mutations in various parts, and lose a little portion of their quantity, before they are made into Urine: For the Latex or Humour to be converted into Urine, is first of all received into the Ventricle, (for I assent not to *Rensner*, who affirms the same falling for the most part on the Lungs, to cause the more quick making water after drinking) whilst that it stays in the Ventricle, it is there boyled; also impregnated with Salt and Sulphur of its own, or from more solid Aliments dissolved: then very much of it is confused in the blood, with the nourishable juice; which, when it is a long time Circulated, from thence receives a farther tincture of Salt and Sulphur, according to the various temper of the Blood, and its inkindling in the Heart: Hence some portion of it is derived with the Animal Spirit, to the Brain and nervous stock; and afterwards from thence, being made lifeless and weak, is lastly reduced into the bosom of the Blood; after that it hath bestowed on the Blood and Nervous Juice, whatever of generous or noble is contained in the Serum, also no small quantity is consumed by sweat and the other emunctories; what remains, whilst that the Blood continually washes the Reins, a precipitation being made, either by a straining or force of a certain ferment, it is there separated from the Blood, and from thence passes thorow the Ureters into the Bladder, and so is carryed forth of doors.

From the origine and lustration of the Serous Latex, but now described, it plainly appears, that the Urine ought to answer to the quantity of the liquids taken, in somewhat a lesser proportion, perhaps under a third part; which plainly shews the disposition and strength of the Viscera serving for Concoction, as also the temper and distribution of the Blood it self, and after a sort of the nervous juice; moreover it carries with it signs of the affections of the Urinary passages. The quantity of the Urine declines often from this Rule, so that sometimes it superabounds, also sometimes is deficient: and either for a short time, may consist with a disposition not much unhealthful; but if these kind of distempers continue long, they argue a sickly condition. Concerning these we shall speak among the appearances of the Urine in a diseased condition of the Body; we shall now next consider the colour of a sound Urine.

The Urine of Sound People, which is rendred after Concoction is finished in the Body, is of a Citron colour, like Lye a little boyled: which without doubt proceeds from the Salt and Sulphur of the nutritious juice, and the Blood, dissolved in the Concoction, and boyled in the Serum. This colour doth not arise only from Salt (as some would have it) because the Liquor impregnated with Salt, unless it be evaporated to a certain thickness, will not grow yellowish: Also Salt of Tartar, being dissolved by melting, continues still clear. What may be objected concerning the Lye of Ashes, I say, there the whole Sulphur is not consumed by burning, but the Citron colour arises from some saline Particles, and others Sulphureous burnt, and sticking together in the Ashes, and then infused or boyled in the liquor. Neither doth the Urine of sound people acquire this same colour from Sulphur only, because Sulphur in a watry Menstruum, is not dissolved unless by the addition of Salt, nor will it give any tincture of it self; but if Salt of Tartar and common Sulphur be digested together in water, or if Antimony be boyled in a saline Menstruum, both liquors will by that means grow yellow like Urine; after the like manner, the saline and sulphureous Particles of Aliments, being incocted and most minutely broken in the Serum, by a Digestion in the Ventricle and Intestines, and by a Circulation with the Blood in the Arteries and Veins, impart to it a Citron Colour.

This kind of dissolution of Salt and Sulphur, by whose means the Urines are made of a Citron Colour, is first begun in the Bowels; and afterwards perfected in the Vessels, and very much depends upon the Concoction performed in the Ventricle and the Intestines: For here, by the help of heat and of ferments, the Aliments taken are chiefly subdued; the bond of mixture being broken, the saline and sulphureous Particles being most smally broken, and made small, go into a milkie Cream, and from thence the Serum remaining after that Concoction and distribution of that milkie juice, becomes of a Citron colour: after the same manner, as when the Salt of Tartar and common Sulphur being dissolved together, and mixed with some acid
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thing, indue a milkie colour; then the contents being separated by settling, the remaining liquor grows yellow like Lye. If that the aliments, by reason of an evil disposition of the Ventricle, are not rightly digested in the first Concoction, as in the Longing Disease or Pica, the Dropsie, and other ill dispositions of the Bowels, usually comes to pass, the Urine also is rendred crude, clear, and almost insipid, like Fountain water; but if by reason of the ferments of the Viscera being more than duly exalted, or otherways depraved as in the Scurvy, Hypochondriac distemper, or Feavourish intemperance, the particles of things eaten are too much dissolved in the first Region, by that means Urines are rendred red, and thick.

The Serum, as hath but now been said, being imbued with a lixivial tincture in the first Concoction, and confused in the Blood, so long as it is circulated with it, it is yet further Concocted, and acquires a more deep colour; for the particles of the Blood being roasted and scorched, although for the most part they are laid aside into the Gall bag, yet being in a manner boyled in the Serous Latex, they heighten its colour; hence the Concoction being ended, the Urine which is first made, is more Pale, and that which is last, more Red. That which is made after long fasting, is yet more high Coloured. Where the Blood is more cold, as in Cachectical people, the colour of the Urine is made less; where the Blood grows raging with a feavourish Heat, and is roasted, the Urine grows highly Red.

Concerning the Urines of sound people, it is worth observation, that which is made after plentiful Drinking, hath no tincture, but is pale like water; of which we shall enquire, by what means the Serous Latex so suddenly slides away out of the Ventricle, (contrary to what is vulgarly believed) and passing thorow all the Chyliferous passages, then the Veins, Arteries, the bosom of the Heart it self, and the turnings and windings of the Veins, and Ureters, is put forth of the Body within so short a space: moreover, how it comes that the Urine being so precipitately made, contrary to most other things, is not only changed into no Colour in its passage, but it also loses its own proper: For as the Proverb is, *Our Drink goes thick in, and comes forth thin: or We Drink thick Beer, and Piss clear.*

Concerning this we say, that besides the long wandring of the nourishing juice, to wit, whereby, after some stay in the Ventricle, it slides into the Intestines, and from thence thorow the milkie Vessels into new passages, and thence is carried into the Veins, (which carrying about cannot be quickly performed) it is most likely, that there is another nearer passage of the same Nutritious Juice, whereby indeed it may be conveyed immediately and without delay to the Mass of Blood, and perhaps to the nervous Liquor; and therefore, after fasting there immediately follows a most quick refection of strength and spirits, after Eating, and especially after Drinking; which indeed cannot be thought to be made by the Spirits and Vapours; also from such drinking, the Urine is presently rendred, and indeed sooner than it can be thought, that the Mass of the Chyle can be sent out of the bosom of the Ventricle; wherefore, it is not improbable, that when the Alimentous Liquor is entred the Ventricle, presently the more thin portion of it, which consists chiefly of Spirit and Water, is imbibed by its Spongy Membranes; and from thence being instilled into the little mouths of the Veins, it is presently confounded with the Blood, flowing back towards the Heart. For of this opinion (though not very stubbornly) I always was, *That the Chyme was in some measure immediately derived from the Ventricle, and Intestines, by the branches of the Vena Porta, into the Mass of Blood; and as the milkie passages carry it about by a long compass, whereby it may be instilled into the descending Trunk of the Vena cava; so that it may be carried in a more near way, viz. into the ascending Trunk of the same, by these Vessels; forasmuch as the Blood being made poorer in its Circulation, returning from either part, before it had entred the Heart, it ought to be refreshed with a new juice, whereby it might more lively ferment in the bosom of the Heart; but forasmuch as the much greater part of the Blood is carryed upwards, surely it may seem agreeable to truth, that at least some portion of the nourishing Juice may be added to this, as it were a sustenance, it being before burnt forth, and almost lifeless, for its new inkindling in the Heart.* The Arguments that seem to perswade to this, not of light moment, I could here heap together, but I should so divert far from our proposition: wherefore, that we so suddenly make a watery Urine after Drinking, I esteem to be done after a manner as was but now said; therefore the Liquor that is carryed so hastily from the Aliments to the Mass of Blood, passing thorow the so narrow windings (as are the

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Membranes of the Viscera) being drawn as it were by distillation, the more thick matter being rejected, consists almost only of Water and Spirit; with which indeed it refreshes the vital Spirits, and dilutes the Blood; about which task, when the spirituous part is consumed, the watry Latex, because of its plenty, being heavy and troublesome, is continually sent away by the Reins; and when it comes from the Ventricle, not yet imbued with Salt and Sulphur, nor is long circulated with the Blood, that it might by that means acquire a lixivial tincture, it is rendred thin, and clear.

C H A P. III.

Of the Consistence and Contents of the Urine of Sound People.

SO much for the Quantity and colour of Urines, which proceed from a sound Body; but as to what belongs to the Contents, we must know, that there ought to be nothing besides the Hypostasis in a sound Urine; but what this is, and by what means it sinks down, remains to be unfolded in the next place.

So long as the Mass of Blood, being fused with the serous and nourishable humour, is continually Circulated in the Vessels, from it a certain nutritious juice is made, by a perpetual digestion, which being put continually to the solid parts, goes into nourishment: This first of all is digested into a glutinous humour, like the white of an Egg, afterwards into thin Filaments or Rags, which being interwoven in the Pores and little spaces of the solid parts, still afford to them an increase of new substance; but whilst the Serum being mixed with the Blood, washes all the Regions of the Body, it sucks up into it self a certain superfluous portion of this last Aliment, to be lay'd on the solid parts, and carries it forth of dores with it self; and this it is that constitutes the Hypostasis or settlement in Urines; wherefore so long as this is present, it indicates how far Concoction and Nutrition in some measure is performed, and is accounted a laudable sign; its absence shews Crudity and Cachectical people, or a Dyscrasie in Feavours; it consisting of small Threads or Filaments, is dispersed at first thorow the whole body of the Urine, and then is collected into a little Cloud, by this means. These Filaments or Threads, are long, and smooth, also indued with some sharpnesses like Brier-pricks, that from thence being shaken about, they easily lay hold of one another, and are fastned together; even as if into an Urinal full of water, you should cast many Hairs, and then by shaking about the Vessel, the hairs at first swimming dispersedly, in a little time would lay hold on one another, and be collected into a little bundle; after the same manner (as it seems) the little threads which constitute the Hypostasis or settlement being variously here and there agitated by the colour and spirits implanted in the Urine, intangle and thrust upon one another, untill they gather into one little Cloud by the mutual knitting of all together; and because these Filaments are compacted, and more solid than the other Contents of the Urine, they sink towards the bottom with their weight.

It is very likely, that these kind of Filaments, make the Hypostasis in the Urines of Sound people, for that the Blood being well constituted, and disposed to nourishment, is very much stuffed with Fibres, or white Filaments: because, when a Vein is opened, if the Blood let out be received into warm water, it will be conspicuous to any one; for the red thick substance being diluted with the liquor, these smooth and white threads swim in the water; wherefore it seems, that some of these thin or slender rags, being snatch'd away with the serous juce, are the matter of this cloud subsiding in the Urine; wherefore in Cachectical people, by reason of Crudity, the Blood being very waterish, and unfit for nourishment, is destitute of these well labour'd Fibrils; also in Dyscrasies, when the nutritious humour, the Blood being too much scorched, is not rightly concocted into these kind of Filaments, the Hypostasis in Urines is either wholly wanting, or is very confused and disturbed.

It is said to be a good and laudable Hypostasis, which is of a whitish colour, of a round and equal figure, and sinks towards the bottom, to which are required, First, that that last Aliment be rightly labour'd, whereby the Filaments may become white, smooth, and solid, like to slender Fibres. Secondly, that the Urine be sufficiently strong in spirits, which (as is beheld in the growing hot of Must, or new Wine)

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may agitate, and compel here and there all parts. Thirdly, that the liquor be not too thick, nor that its Pores be first possessed by strange bodies, whereby the motion of the contents may be hindred, but that a sufficient space may be left, for the free agitating and tossing about these kind of Particles.

If the substance be red, it is a sign that that last Aliment is scorched and burnt, with too much heat; wherefore such a sediment, for the most part is in the beginning of a Feavour, so long as the Coction in the Viscera and Vessels, is not wholly perverted; if the Hypostasis be broken and unequal, it is a sign that the nutriment destinated for the solid parts, is not rightly and equally concocted, and that its Particles are not homogeneous, and alike in every part: wherefore the Filaments do not cohere together, but these with those, and they with others, are entangled apart; hence some more thick descend towards the bottom, and others more light swim upon the top. When the Hypostasis does not wholly sink down, but hangs all of it, either in the middle or upper Region, that happens, because that those Filaments are not perfectly laboured, nor solid and compact, but more rare and spongy, or because the liquor is thicker, and more impregnate with Salt and Sulphur, and therefore like Lie it sustains some weights, which otherwise would sink to the bottom. Sometimes the Hypostasis is wholly wanting, in sound people, after long fasting, immoderate labours, or copious sweating, the matter being wholly consumed into nutriment, or evaporated by sweat; in Feavours, by reason of the very depraved condition of the Blood; also in the Pica, Cachexie, and other Distempers of that kind, by reason of the great Crudity.

Concerning the consistency of the Urine in sound people, there is not much worthy consideration to be met with: It is wont to be of that sort, as midling Beer is, being purified by a long Fermentation; or Lye a little boyled, *viz.* the watry liquor of the Urine, ought to include in its Pores and passages, a great many Particles of Salt, and Sulphur, most smally broken, and dissolved; and besides a little of earth, divided very exceeding small, and dispersed thorow the whole body of the Piss; if the consistence be thinner than it ought, as it is in clear, or limpid Urines, and watry, it is a sign of indigestion and crudity; that the Aliments are not fully overcome, and Concocted; but if the Urine be thicker, and closer than it ought, it is a sign, that the body of the liquor, is filled with preternatural Contents. But of these elsewhere, when we shall speak of the Urines of the Sick.

Thus far of Urine, forasmuch as it is an Excrement, and sign of Concoction in a sound body (truly performed in the Viscera and in the Vessels) the quantity or bulk of which is to be determined by the potent matter; the colour Citron, from the dissolved Salt and Sulphur, and boyled in the Serum; the Hypostasis or Contents depend upon the Filaments, elaborated in the Blood, for the nourishment of the solid parts; the consistency on the Salt and Sulphur, together with the Particles of Earth, filling the Pores and passages of the serous liquor. It next remains, that we treat of the Urines of sick people: in which also, the Quantity, Colour, Contents, Consistence, and some accidents besides, offer themselves to consideration.

CH A P. IV.

Of the Quantity and Colour in Urines of sick People.

IN a Morbous provision of Bodies, or Sickly estate, the quantity of the Urine does not exactly quadrate with the proportion of the liquid things taken; for sometimes it wants of its due measure, and sometimes exceeds it. When the Urine is much less than the drinkable things taken, the reason is, because the watry Latex either stays somewhere in the Body, or is diverted by some other way of Excretion, than by Urine: if it remains within; First, it is either heaped up about the Viscera, and their Cavities, and so is stay'd now in the Ventricle, more than it ought to do, and induces by the distention of it, troubles, with spitting; but more often, it is laid up in the hollowness of the Abdomen, and sometimes of the Thorax and head, and there is wont to cause Hydropic Diseases. Or, Secondly, the Serum stagnates in the Vessels, and so increases the bulk of the Blood, and Nervous Liquor, and

and notably perverts its motion ; whence Catarrhs , Rheumatick distempers , and often Palsies and Convulsions are caused. Or thirdly, this watry humour is fixed in the habit of the body , and so creates a swelling up of the whole body , or of some parts. Or fourthly and lastly, it is obstructed in the urinary passages, by the Stone, or thick matter , as it were a dam opposing it ; and causes in those parts pains and Convulsions , and a fulness of the Serum in the whole body. When the serous water is other ways bestowed , the Patients are for the most part prone to frequent and troublesom Sweats, or almost to a continual Loosness.

The distempers therefore which the small quantity of the Urine is wont to indicate, are sometimes the swelling up of some of the Viscera , and a heaping up of water in them , sometimes Catarrhal distempers , sometimes evil dispositions of the nervous stock : sometimes an Anasarca and watry Tumors ; and sometimes the stony disposition of the Reins and Bladder. And sometimes also the diminution of the *Urine* is the effect and sign of some other preternatural evacuation, *viz.* an immoderate excretion of Sweat, Lask , or some other thing. To describe here exactly all the subsistences of the serous Latex , either in the body , or the causes of it other ways excreted, and the manner of doing it , were to transfer hither almost the whole matter of Pathology ; for many and divers are the occasions and circumstances, whereupon this Serum is heaped up in this or that part , and subsisting in the body , diminishes the quantity of the Urine ; but for the most part the principal and most frequent cause of this consists not so much in the fault of the Liver, Spleen, or Reins, as of the blood it self : to wit , a copious and free making of Urine , as also its stay in the body, and only made in little quantity , depend chiefly on the temper of the blood , and either on its kindling, or fermentation in the heart : for if the blood be strong in rightly exalted principles, (*viz.* Spirit, Sulphur , and Salt) it grows very hot in the Vessels , and so the frame of the liquor being loose enough , it is duly kindled by the ferment of the heart ; and almost spiritualizes the whole , passes through all parts with heat and a rapid motion , without stopping , and whatsoever is superfluous and volatile , evaporates out of doors : and whilst the blood is rarified , and boiling with heat , passes through the Reins , what is serous is easily separated , either by the strainer of the Reins only , or (which is most likely) by a coagulation , and is as it were precipitated from the remaining mass of the blood. The same thing almost happens after this manner to the blood , as we may observe in Milk, *viz.* whilst it is warmed , and grows hot , it most easily goes into parts , and its Serum is most easily separated by the least drop of Runnet, or Coagulum put into it : but if you pour much more strong and sour ferment into it , when it is cold , a precipitation will hardly follow ; so if the blood becomes through an evil constitution , or ill manner of living , more cool and watry , that being less endued with active Elements, it grows but dully hot , and is but little kindled in the heart ; it is circulated very slowly and difficultly in the Vessels ; passing through the Pores and passages of the Viscera, it cleaves a little to them , and leaves something behind it ; whence are begotten every where Obstructions and Tumors ; also the blood by this means becoming viscous and cool, and so unfit for precipitation or percolation, lays aside less readily its excrements in the Reins ; but leaves them every where in the body , because it hardly , and not without the residence of a certain humor, is circulated. Wherefore in this state , those things that move the blood very much , as exercise and a more quick motion ; or also such as may fuse it, as it were with a Coagulum or Runnet, as are sharp things, and preparations of Salts, will more freely provoke Urine.

It sometimes happens , that the Urines of the sick are made in a large quantity, and very profuse , that in a day and a nights space , they make perhaps twice or thrice as much water, as the Liquids they have taken ; the causes of which distemper are also various , and the significations very divers ; if after the suppression of Urine, or its quantity formerly lessened , if in Hydropick distempers , Rheumatisms , or passions of the nervous stock , or in the Crises of Feavers , a flowing down of the Urine follows , either of its own accord , or by the use of Diureticks, it denotes a Cure of the disease , or preternatural disposition , or at least a declining of it. But if (as I have often observed) in a lean and weak constitution (without any of the previous distempers but now recited) the Urine exceeds much the Liquids taken, and from thence a great debility of the whole follows ; this indeed signifies an evil disposition , with a tendency to a wasting or Consumption. I have known some women of a tender and most fine make , who sometimes being ill , for many days,

were wont daily to make water in a great abundance, (exceeding twice the Liquids taken) and that watry and thin, without contents or settlement; at which time they have complained of a languishing of strength, difficult respiration, and an impotency to motion. I suppose in this case, that the blood and nervous juyce grow too sour, from the salt carried forth, and suffering a Flux, and therefore that they are somewhat loosned in their mixture, and fused so much into serosity, as to be made fit for it. For it is to be observed, that all Liquids, though more thick and mucilaginous, if they be kept to a founnels, presently become for the most part watry and limpid: also the flowing down of the Urine is sometimes seen to arise from such a disposition of the blood and humors: for that the Urine so copiously excreted, is like Vinegar in taste; and these kind of distempers are usually cured, chiefly by Chalybeates, and not by binding and thickning things.

But as to what respects the Colour, the Urine of sound people may be the square or rule, to which all the rest of the sick may be referred; for as the colour of sound peoples is Citron, the Urine of the sick is paler than Citron, and so either watry, or white, or higher coloured than it; whose chief kinds are, flame-colour, yellow, red, green, and black. I shall run through every one of these briefly, and endeavour to weigh them together, by what causes all the alterations may be made, and what distempers, or provisions of diseases they are wont to make known.

The Urine is watry or limpid, when by reason of the indigestion of the Ventricle, the saline and sulphureous particles of things eaten, are not rightly subjugated, nor being finally broken, are made so volatile, that being dissolved in the Serum, they may impart to it a tincture, which it may carry with it, through the several turnings and windings of its passage: For the Latex or juyce to be changed into Urine, because it is forced through very secret passages, and narrow, as it were by a certain distillation; therefore it is wholly deprived of the colour and consistency, which it had from the taken Liquids, and imbibes almost nothing, but the volatile part, from the Chyme, whose Vehicle it is. Wherefore, if by reason of the great crudity, the Salt, Sulphur, and other contents are not first made volatile in the Viscera, nor afterwards dissolved in the Vessels, that they may make their passage together with the serous juyce; it being at last stripped almost of all, is sent out like clear water. That such Urines do want the active principles, it is a sign, because they are kept a long time from putrefaction: This sort of Urine denotes in Virgins, for the most part, the Green-sickness, in most the Cachexy or Dropsie; in all it is a note of indigestion and crudity. Sometimes in those obnoxious to the Stone, it foretels the approach of the fit, *viz.* whilst the Serum is coagulated by the stony juyce in the Reins, its dissolutions and contents are congealed into a tartareous matter, only a watry juyce or Latex staying behind. Those who for some time make a thin and watry Urine, whatever sickness they are obnoxious to, have often adjoined to it a difficulty of breathing, and shortness thereof after motion, and a distention about the region of the Ventricle, and as it were a swelling up after eating. The reason of the former wholly depends on the defect of spirits in the blood, because its liquor is not fully imbued with active principles (of Spirit, Sulphur, and Salt) rightly exalted; therefore it is not sufficiently kindled by the ferment of the heart, whereby the whole may presently leap forth, and break as it were into a flame: but that hardly fermenting, and being apt to stagnate in the heart, and for the most part to reside there, burdens it grievously: wherefore if the blood so disposed, is urged more than it is wont, by a more quick motion, into the bosom of the Heart, because not being rarified of its own accord, it may presently go wholly forth, therefore there is need of great endeavour of the Lungs, and a more quick or frequent agitation, whereby it may be carried forth. Therefore watry Urines signify this kind of Crudity in the blood; because, for as much as they receive no tincture almost from the Salt and Sulphur, it is a sign that the Particles are little dissolved in the mass of blood, or are rendred volatile. As to what appertains to the inflation of the Ventricle (of which also limpid or clear Urines are the effect and sign) I say, because of a defect of due Fermentation, the Chyle goes not into a volatile Cream, but (like bread not fermented) into a sad and heavy mass; which indeed is slowly, and not without a residence of viscous Phlegm, carried out of the stomach: its reliques being impacted in the folds and Membranes of the Ventricle, obstruct all the Pores and passages, that nothing may vapour forth, nor that the thin and spirituous part may be conveyed (as it ought to be) by the secret passages, to the blood: hence flatulencies are be-

gotten,

gotten, which continually distend the Ventricle, and blow it up beyond its due bulk: also when those Feculencies are left a long time in the stomach, they abound in a fixed Salt, and degenerate now into an acid, now into a vitriolick matter, or of some other nature; from whence Heart-aches, desire of absurd things, oftentimes Heat with cruel thirst, and sometimes Vomiting arise: some of which though they argue a very sharp heat to lye hid within, yet by reason of the want of concoction, such distempers often render the Urine crude and watry. We have treated thus largely of a limpid or clear Urine, because from hence the reasons of the rest (which as to colour and consistency are pale and thin in healthful persons) may be drawn. For from the Salt and Sulphur, more or less dissolved and boiled in the Serum, the appearances of a pale and straw-coloured Urine, and of other colours, under a Citron colour, are excited; and by the like means, which was said of the watry, they may be unfolded.

There remains another certain kind of Urine, more pale than the Citron colour, not thin, but thick and cloudy, and of a whitish colour; it appears by common observation, that children do often make such water, when they are troubled with the Worms: The reason of which seems, because the matter whereof the worms are made, is a certain viscous Phlegm, heaped up in the Viscera, by reason of the indigestion of the Chyle, and a defect of making or generating Spirits, which matter at first transmits no tincture to the Urine, because of its fixity, the same afterwards putrifying is exalted, and is in some manner volatilized; and then partly by heat and spirit, is formed into worms, and partly being confused with the passing Chyle, and carried into the vessels, when 'tis made unfit for nourishment, it is separated with the Serum from the blood, and being mixed with the Urine, gives it that white colour. Sometimes also in Feavers, especially of children, the Urine is whitish: the reason of which is, because the supplement of the nutritious juyce being poured from the Chyle to the mass of blood, is not rightly assimilated, but degenerates into an excrementitious humor: A portion of which being incocted in the Serum, imparts to it the thick consistence and milky colour: otherwise than in the Feavers of those of riper years, where when the heat is stronger, the same degenerate juyce impresses on the Serum a red colour. Also the Urine is whitish in the flowing of the Whites, the Gonorrhœa, Ulcers of the Reins and Bladder, and of the urinary passages, by reason of the confusion or mingling of the filthy matter, or the corrupted seed: however it be, that the colour of the urine be white, it is produced from its contents, which at last putting down its settlement to the bottom, the liquor for the most part becomes of a palish and yellowish colour; even as it may be perceived by the making of the Milk of Sulphur, where the milky substance sinking down to the bottom, the over-swimming liquor is of a Citron colour.

Urines whose colour is deeper than Citron, owe their appearance, not only to the Salt and Sulphur dissolved more than usual, but in some sort to the more thick contents in the liquor. The more plentiful dissolution of the Salt and the Sulphur, is chiefly performed in the vessels, in the mass it self of the blood, and from thence the Tincture is impressed on the serous Juyce: But this happens to be done for the most part, after a double manner, *viz.* either by reason of the feaverish fervour, for as much as the blood boiling in the vessels, and being more kindled in the Heart, is very much loosned in its mixture, and so copiously fixes on the Serum the particles of Salt and Sulphur, wasted as it were by the boiling: Or without a Feaver, when these kind of sulphureous and saline little bodies, wont to be sent forth at other sinks, are restrained; and so being by degrees heaped up in the blood, are poured into the Serum. Of this also there are two chief causes or means; for either the excrements of the blood, which chiefly participate of adust Sulphur, and that ought to be sent away by Choler-carrying vessels, are retained, and so they impress, being suffused on the serous humor, a tincture of yellowness: or else the Effluvia's, which are chiefly of a saline nature, and ought to be evaporated by insensible transpiration, are restrained, and from those the urine is filled with a lixivial tincture. The urines of the former kind are proper to people that have the Jaundice; but those of this latter are familiar to the Scurvy: for in the Scurvy the saline particles of the blood depart from volatilization, and get a Flux: wherefore, by reason of their fixity, they will not evaporate, and so being more fully heaped together in the blood, they more and more pervert its Crasis, and very much impregnate the serous humor with a saltiness. The contents which heighten the colour

of the urine, are of a twofold kind, to wit, either adust recrements, remaining after the deflagration of the blood, or particles of the nutritious juyce, degenerated into an extraneous matter: Concerning which we shall speak hereafter in their proper place. It now remains that we describe particularly the several Colours of Urine more intense or deep than Citron colour.

1. The first is a flame-coloured urine, which shines with a brightness like the Spirit of Nitre: and this is very often seen in an intermitting Tertian Feaver; this colour arises from a portion of the thinner yellow Bile, mixed with the Serum, whilst it is in motion: for that in this Feaver there is a sharp and hot intemperature of the blood, which burns and scorches all the humors, and so plentifully begets Choler. But although this, for the most part, is separated from the mass of blood by the biliary vessels and passages; yet when it abounds in the vessels, a part of it, or (which is the same thing) some burnt and adust particles of the blood and humors being boiled in the serous water, impart to it an high or deep yellowness. This urine is thin and shining, for that there is in this disease almost a continual breathing forth, that thrusts out the recrements of the nutritious Juyce, and all the thicker parts of the Serum towards the circumference of the body.

2. The Saffron-coloured urine, and which dyes Linen with the same colour, undoubtedly is a sign of the Jaundice: it is tinged after this manner by the yellow Bile or Choler, or by the Salt and Sulphur burnt and plentifully mixt with the Serum: for the yellow Bile is necessarily begot from the yoked heat and motion of the blood; but for this the Gall bag is designed by Nature, for the separating it from the mass of the blood, its passages being rooted in the Liver: But if such a separation be any ways hindered, that humor flowing back in the blood, and copiously heaped together, infects the skin with its yellowness, the blood, and especially the serous Latex. The Saffron-coloured urine differs from the flame-coloured, because in this only a certain portion of the more thin Bile is poured into the urine, but in that the more thick part, and much more plenty: besides, in the yellow Bile the Sulphur, with the Salt, being joyned and long circulated, is fully dissolved by it, that it becomes like paint, imparting to every subject a Saffron-coloured tincture; as when common Sulphur and Oyl of Tartar are mixed together. But what things cause a redness in urines, without the restagnation of this Bile, happen after the same manner, as in the Lye of Ashes: where the particles of the Sulphur, without any previous disposition from the saline, are forthwith put down with them in the Liquor.

3. It remains that we speak next of red Urines, which are of a divers habit, neither do they always depend on the same causes, nor plainly denote the same kind of distempers; we shall briefly run through the chief differences and proper significations of them. First, the liquor of the urine is either red of it self, and remains after the same manner, nor is the colour altered by the settling or sinking down of any of the parts: or secondly, the redness of the urine chiefly owes its colour to the Contents, which being settled to the bottom, the liquor grows yellow, or is less red. The distempers that these kind of urines are wont to shew, are chiefly Feavers, and a confirmed Scurvy, and Consumption. We shall consider the reasons of each.

1. When the Urine that is made red so remains, it is first either of a mean consistency, and somewhat clear, and then it owes its colour to the Salt and Sulphur, being burnt more than usual, and so boiled more copiously in the Serum: or secondly, such an urine is red, and also troubled and cloudy: but this, besides the contents of Salt and Sulphur, has boiled in it some earthy particles also, which indeed being impacted in the Pores and passages of the serous Latex, do not descend: because the liquor of the urine is destitute of convenient spirits, which may segregate all heterogeneous things, and drive them to the bottom, as is wont to happen usually in dead drink, or Beer growing sour by reason of Thunder; where the liquor is infected with a troubled Feces, and by reason of the defect of spirits, will not grow clear; wherefore this kind of urine is a very bad sign in Feavers, because it shews such a confusion in the blood of adust and to be separated matter, such as the vital spirits are not able to master by taming and subjugating it.

2. Sometimes the Urine is made red, by reason of its contents; which settling in the bottom, the liquor becomes of another colour: but these contents, as before we hinted, are twofold, *viz.* now thin, which are the remaining matter, or adust recrements after the burning forth of the blood; now more thick, to wit, the degenerate particles of the nutritious Juyce; both these being torried, and separated from the

the burning blood, are partly thrust forth by Sweat, and partly mixed with the ferrous Latex, thicken its consistence, and heighten its colour, *viz.* so long as these kind of contents are included in the Pores and passages of the liquor, they are sustained, the colour of the urine appears more deep, and the consistency thicker: but these being precipitated to the bottom, both the redness and thickness of the liquor are lessened. The reason of this shall be given anon, where we shall speak of the Causes of the Colours, and also of the Clearness and Cloudiness of Urines: we shall now inquire, what is the reason of the difference, that red urines are wont to be made both in Feavers, and also in the Scurvy, Consumption, and perhaps in several other distempers.

1. In Feavers, the liquor of the Urine is filled with redness, because of the more plentiful dissolution of the Salt and Sulphur, and their particles copiously boiled in the Serum; for whilst the blood and humors grow hot, from the feaverish cause, by reason of the heat being more fully inkindled, the saline and sulphureous little bodies, being burnt and torrifed, are more dissolved; and being boiled in the ferrous Juyce, impart to it a deeper tincture: Even as if the Lye of Ashes be boiled over the fire, it grows more red, than if it were only made by infusion. Also in Feavers, the contents of the urine most often increase its colour, *viz.* by reason of the intemperance and deflagration of the blood, both the degenerate particles of the nourishing Juyce, and also other matter (as it were the Ashes remaining of the burning of the blood) are burnt together, as it were into a reddish Calx; which being included in the Pores of the urine, renders its colour deep, and afterwards sinking down, makes a sediment like red Oker.

2. In a long Scurvy, the liquor of the Urine grows sometimes so highly red, that it cannot be greater in a burning Feaver: if such urine be evaporated, or exposed to distillation, it will shew great plenty of Salt, with a muddy Feces or dregs: wherefore it seems to be manifest, that this deep redness doth chiefly arise from the Salt, (as we have already hinted) by this Experiment; because in Scorbutick people the saline particles, which ought to be made volatile, and so constantly exhaled by transpiration, become fixed, and being hindered from a flux, are heaped together more plentifully in the distempered body. The Salt remaining within, is variously coagulated with Sulphur and Earth, and then is continually dissolved: and from this diverse coagulation and dissolution, the to be admired Symptoms of this Disease are caused. Also from the saline little bodies plentifully dissolved with Tartarous feculencies, and diluted with the Serum, urines are filled with an high redness; to which most often happen in this inveterate disease vices of the Liver and Gall; for when these Inwards, being either obstructed or other ways depraved, cannot perform their tasks, for the separating the adust particles of the blood, they being more fully heaped up in the blood, are dissolved in the ferrous Juyce, and infect it yet with a more lixivial tincture. And if the adust particles of the Sulphur do excel the rest of the fixed and scorbutick Salt, the yellow Jaundice happens together with the Scurvy, and the urine fixes to Linen a Saffrony tincture. But if they be less than they, and that the saline particles excel, the Scorbutick distemper only is produced, in which the urine is intensely red, yet does not dye the Linen. I am perswaded that it is thus; because, when I have opened the dead carcasses of many dead of the Scurvy, in whom there was a red urine, I observed that the Liver or Gall was in fault: In some the Liver was wholly without blood, and dry like a Cows Udder; in others the bag of the Gall was empty, and nothing in it; in others it was beset with little stones; in others it was filled with filth, not bitter; in all these Inwards were so distempered, that the secretion of the Bile was hindered.

3. By reason of this kind of dissolution of the Salt, Urines sometimes grow red in Arthritick diseases: for besides the Gout (in which such urine is often made) I have observed in some a painful distemper, and as it were like a Feaver, caused, with a very high-coloured urine; they had wandering pains, now in this place, now in that, grievously tormenting, that the sick were scarce able to stand, or to stir their limbs: they were obnoxious to wakings and frequent sweats; they were also troubled much with thirst, and heat of their mouth: and they had a urine highly red, with a plentiful red sediment. In the mean time it did not appear, either by the Pulse, languishing of the Spirits, or Head-aches, that the blood grew excessively hot, or that they had a Feaver. Wherefore I suppose that this kind of distemper doth chiefly consist in the nervous stock, and depends on the exorbitances of the saline Principle, rather than the sulphureous.

4. Also

4. Also in the confirmed Phthisis or Consumption, especially if an Hectick Fever be joyned with it, there is a red Urine; the reason of which is, if at any time an Ulcer is excited in the Lungs, the putrid filth from thence being mingled with the blood sliding by, causes in it almost a continual effervescency, whereby the sulphureous and saline particles being more plentifully dissolved and boiled in the Serum, affect its liquor with redness: besides, by reason of the blood being defiled after this manner, the nourishing Juyce degenerates almost wholly into putrefaction, by whose recrements the urine being filled, grows more red, and is very much stuffed with contents: The sign or note of this is, that the sick for the most part grow hot after eating, and that they are troubled with an heat through their whole body, followed with a nightly sweat; besides, their urines yield a thick and copious sediment, to wit, when the nourishing Juyce, being mixed with the blood, is not assimilated, it stirs up in it a fervour, and being degenerate into an extraneous matter, exhales partly by sweat through the Pores of the skin, and partly being transmitted to the urine, very much heightens its colour and consistency.

Thus far of a red Urine, whose several species, but now related, have more degrees of intention and remission, accordingly as the causes, altering the colour and consistence in them, are either weaker or stronger.

4. As to what belongs to a green and black Urine, I confess I have never seen those kind of deep colours (exactly like those of Leeks and Ink) in any urine: but I imagine I may have seen the appearance of a greenish colour from a more deep yellow, and of a blackish urine from the same with a cloudy and somewhat a dark mixture, and from thence called by Authors a green and black Urine. But those urines, coloured after that manner, are esteemed either signs of the Jaundice, or of being distempered with some virulency of the blood, if they continue so constantly for some time: or such urines, as occasion offers, are variously changed, and are now of this or that, and presently of another colour. So I have known Hypochondriacks wont to make such urines, as it were critically for some time, and then afterwards to render them like sound men. As to the first, when the Jaundice is very great upon them, that the adust portions of Sulphur and Salt remain a long time in the mass of blood, they acquire by a long concoction a fulness of the yellow colour, at first green, and afterwards black, and impart the same to the Serum: For if the yellow Bile, being taken out of the bag of the Gall, and put into a Cucurbit, be exposed to the gentle heat of a Bath, the same in a short time will grow green, and afterwards appear like the blackest Ink: wherefore in the black Jaundice, which is only the yellow carried forth into a worse state, by its long stay or continuance, there is nothing more usual than to make black urines. Besides, these kind of urines sometimes appear in a malignant Fever, and in the Plague, also often from drinking of poyson, and in this case it is for the most part a sign of death, because it argues the blood greatly corrupted, and the spirits profligated, and the bond of the mixture loosned, as it were the deadly or mortified distemper: even as where some part of our body, being distempered with an Ulcer, is afterward taken with a Gangrene or mortification, forthwith the flowing corrupt matter, which was at first white, waterish, or yellow, becomes black. Wherefore in the forementioned distempers, when the urine grows black, the Serum and the blood being wholly vitiated, the skin also is dyed outwardly with such a colour. As to what belongs to urines periodically tintured with a greenish colour, and especially with black (which happen often to Hypochondriacks) it is most likely, that such arise from the melancholick Feculencies laid up in the Spleen, and from thence, by reason of its congestion, too much flowing forth sometimes, and confused with the blood: for such a matter; being often poured into the Ventricle in some men, stirs up black Vomiting; also in others, the same being supp'd up from the blood passing through, may impart suffusions of the same colours to the serous Juyce.

So much for the Colours of Urines, of which the more pale arise from too much Crudity, almost all the high-coloured, either from the Salt and Sulphur plentifully dissolved, and sometimes from the adust recrements throughly boiled in the Serum, or from the more thick contents of the urine; whether they be the Calx and remaining part of the aliment, degenerated in the concoction, or the wasting or melting of the pining body, or some part of it evilly distempered: what hath been said may be better understood, if the means, whereby these kind of dissolved things or contents are able variously to change the colour of the urine, be unfolded.

The causes of the diversity of appearances of colours, and their variously changing, as also of the cloudiness and clearness in Urines, (as in all other Liquors) depend only on the various incidence and emission of the beams of light, as is hinted in another place, in the Tract of Fermentation: For if the substance of the liquor be rare and thin, with open Pores and passages, that the beams of light may easily pass through, it is shining and clear like fountain-water: but if the Pores of the liquor be filled with contents, or little bodies swimming in it, so that the luminous beams are broken in their passage, but so that at length they may shew themselves, according to those various manners of refraction and emission, there will appear a Citron, a Saffron, or red colour in a yet clear liquor. If that, in the little spaces of the Pores yet more obstructed, the light cannot pass through, there is a darkness induced: but then if the immersed beams be a little or nothing reflected, the liquor will appear of a brown or dark colour; but if they are beaten back, according to the diverse manner of reflection, a white, ashy, or some other kind of appearance, is induced. From this being supposed, according as the liquor of the urine, sometimes almost wholly deprived of Salt and Sulphur, and other things dissolved, easily admits of light, sometimes either very much stuffed, or else moderately with these kind of contents, either distorts the beams falling on them in their passage, or wholly imbibes them, or lastly beats them back; it were easie to explicate all the Phænomena or appearances of colours and their consistence.

It often happens, that the colour of the same Urine is variously changed: for what is made red, being exposed to the air, becomes white, or of a dark colour, and then after a long time of a Citron colour: the reason of which is this, if I am not deceived, this kind of urine, when it is made, is red, because the Pores of the Liquor are very full of contents; yet so long as they are dilated with heat, they transmit the rays of light, (although variously distorted) that they may at length shew themselves or appear; but this urine is no sooner exposed to the cold, but that the Pores being straitned, the site and position of the parts is changed in the contents, and by that means the passage of the beams of light is hindred: wherefore the liquor presently becomes cloudy, and according as those beams are reflected after this or that manner, a white, or brown, or some other kind of colour is induced: but at length the contents falling down towards the bottom with their weight, the Pores being freed, transmit again the rays of light, and do not distort them; wherefore a clear or a Citron colour appears.

From these things which have been spoken concerning the Colours of Urines, may appear what is the cause of the various consistence of urines. For as the particles of Salt and Sulphur, of the adust matter, or nutritious Juyce, depraved in the assimilating, are more or less boiled in the Serum, urines also get their more thin or thick consistency. It remains next that we speak more clearly of the Contents in preternatural Urines, whereof we have often made mention.

CHAP. V.

Of the Contents in the Urines of sick People.

WE suppose the Contents in the Urines of sick people to be twofold, *viz.* either universal, which proceed from the mass of Blood, and of the nervous Liquor, and respect the habit of the whole Body; or particular, which are the layings aside or excrements of one bowel, or part ill affected, of which we shall speak anon. Those of the former kind, which come away from the whole, are either natural, *viz.* Filaments or small threads constituting the Hypostasis or settlement, as in sound Urines; or preternatural, which chiefly are particles of the nutritious humour degenerate from assimilation, and constitute the more thick bodies of the sediment in Urines; and lastly to these, (if there be a feaverish intemperance) the adust matter of the blood after deflagration, and diluted in the serous Juyce, is added, and increases the bulk of the Contents.

But these Contents, both natural and preternatural, of Urines, represent themselves after a various manner, as the blood more or less unduly grows hot, also as the

the aliments in the bowels and vessels are variously concocted, and either the superfluities or corruptions of the Chyme, from thence made, are washed away with the Serum: for if the nourishable humour transmitted to the blood, is not all perverted, but a great portion of it, laid upon the solid parts, is changed into nourishment, some parts of this also rightly made, being mixed with the Serum, impress yet some marks of an Hypostasis in urines: Also from the adust or degenerate matter, a preternatural sediment is framed, yet little and thin, neither doth it wholly blot out the appearances of this natural. Wherefore in the beginning and declination of a Feaver, sometimes also in a Consumption, or a Cachexy an Hypostasis, though not so perfect, is perceived. If that the greater portion of the same Chyme, growing hot with the blood, by reason of the immoderate heat, is perverted into an heterogeneous matter, which afterward is sent away with the Serum, as hurtful and unprofitable, presently an obscure and imperfect Hypostasis appears; and besides it, very many contents are seen in the urines, which heighten their colour and consistency. Such an urine, which contains an Hypostasis, though imperfect, together with other things of the same kind dissolved in it, if it be kept in a warm place, the Hypostasis will be perceived alone; but the rest of the contents, comprehended in the pores of the urine, dilated by the heat, are made wholly inconspicuous or not to be seen: yet afterwards the little spaces of the Pores being straitned by cold, the same contents are precipitated, and by that means they render the site and position changed, and the urine troubled and cloudy, and blot out the appearance of the Hypostasis. These kind of urines in the better state of Feavers, in a Catarrh, Cough, difficulty of perspiration, fulness of humours, and in the more light Dyscrasies are wont to be made.

But if in the more grievous state of sickness the Concoction be wholly vitiated, and the whole nutritious Juyce changed into a putrefaction, these kind of contents also may be perceived in the urine without an Hypostasis, and signifies variously in diseases, after their various ways of being precipitated, and sinking down, and constituting a diverse kind of sediment; to wit, as the separation of the parts succeed soon or late, or not at all; and as the matter falling down shall be little or much, or also of a white, red, or dark colour. I will briefly run through what is most notable and worthy observation concerning this thing.

1. This kind of Urine being full of contents, is not sometimes at all precipitated, (unless the substance of the liquor be dissolved by putrefaction a long time after) but remains a long while troubled and somewhat cloudy, with little bodies swimming through the whole. The reason of this is, either because these contents are too much incocted in the Serum, so that the spirits implanted therein, cannot separate the pure from the impure, the thick from the thin; as may be perceived in brewing Beer, if that the Mault be too much boiled, the liquor shall never grow clear: or else the urine remains troubled, because it is wholly destitute of spirits, which may compel the parts of the liquor into the motion of Fermentation; as it usually comes to pass in Beer growing sour by reason of Thunder, or of immoderate heat, and being infected with a troubled Feces or Lee, will scarce ever be rightly made clear again. This kind of urine is perceived for the most part in very dangerous Feavers, and sometimes in a desperate Cachexy, and always portends evil.

2. Sometimes it happens, that the Urine is so full of contents, that it begins to be troubled whilst it is yet warm. I have often observed it, after this manner, in a slow Feaver, whose heat was gentle and more remiss, to wit, in which the particles of the nutritious crassament or substance are depraved, but being a little subdued by heat, or boiled in the Serum, they easily fall out of its pores: as when common Sulphur is boiled in Lye, if that before it be perfectly dissolved, it be taken from the fire, the liquor at first clear and red, by reason of the quick precipitation of the dissolved matter, becomes presently troubled, dark, and of a somewhat whitish colour.

3. But what most usually comes to pass, that this sort of Urine, big with contents, as long as it is hot, and some time after, seems clear and perspicuous when it grows cold, is wont to be troubled, and as if some Runnet were infused to be precipitated according to all its parts; yet the same, if held near the fire, or in warm water for a little space, shall grow clear again. The reason of this is already fully unfolded, where we spake of the Causes of Cloudiness and of Clearness.

4. After that the Urine being exposed to the cold, is precipitated in this manner,
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it may be observed by what means its contents descend to the bottom; for sometimes they settle in a short time: and if the liquor grows clear in the space of two or three hours, it is a sign that the liquor of the urine is not too thick, nor very much filled with Salt and Sulphur: wherefore in the beginning or declination of Feavers, when the heat is slack, such an urine is most often made: sometimes such a settlement follows not but in the space of many days; the reason of which is, because the consistence of the liquor is thicker than it should be, therefore the contents or dissolved things are not so easily let go from its embrace, that they may fall down to the bottom by their weight. These kind of urines are wont to be made in the state or height of Feavers, and most often precede an evil Crisis.

5. Of no less a diverse kind are the sediments which fall to the bottom. That I may pass over in this place the filthy matter, and blood, sand, gravel, and the like, deposited from some parts, I shall mention those which are the products of the whole body, and they for the most part are either white or brown, or red like Oker: If you strain urine, when it hath stood long, through brown paper, you may collect these contents. I have often seen a whiteness like Chalk, and sometimes red like Bole Armene, without doubt there is the same matter of all, to wit, the recrements of the deflagrated blood, and of the nutritious juyce depraved in the assimilating: which, as they are burnt by heat in our body, and diversly perverted, appear also in the urine under a various colour and form; even as Antimony mixed with Nitre, as it is more or less calcined exhibits a Calx, now red, now Saffron-colour, now yellow, now brown: The like reason is (as it seems) of the sediments of urines, which are as it were the Calx of the sulphureous and earthy matter burnt forth by the fire of the Fever in the Viscera and Vessels.

6. Besides these kinds of Contents, which happen in the Urines of sick people, I have often observed, that after the urine had stood a long while, something was affixed to the sides of the glass like sand, and indeed in divers figures; for now these little bodies like sand grow together with a sharp and unequal superficies, now with ridges like the Crystals of Nitre, and some shine and are pellucid like Ice. I have seen these kind of Crystals fixed to the Urinal, sometimes in the urines of those troubled with a Dysentery, also in those troubled with pertinacious wakings. Sometimes in urines, when they have stood long, a certain Cream will swim on the top, as when Tartar is boiled in water: this kind of whitish crust growing together in the superficies of the urine, is commonly thought to be fat and fattish things, and taken for the melting of the solid parts: wherefore such as are wont to make such an urine, are presently pronounced to be consumptive, and in a desperate condition: But indeed that is only a saline concretion, which if put into the fire, will not melt, but grows hard into a crusty substance. Yea both this and the other concrescences of urines are as it were the Tartar brought forth in them by a certain Coagulation: But such a concretion depends altogether on the particles of the fluid or acetous Salt, combined with others of the fixed or Alcalisate Salt: For in every subject where there is a commixtion of the Salts of either kind, Crystallizations and Coagulations of a diverse manner are caused, either spontaneously by Nature, or may be procured by artificial separation: wherefore this kind of urine, on which this Cream swims, or that Crystals gather in the sides of the Vessels, indicates the blood to be departed from its sweet and Balsamick nature (such as depends on the volatile Salt) into an acid and corrosive, by reason of the flux and fixity of the saline Principle. Such an urine, if it be evaporated, leaves in the bottom of the Vessel great plenty of Salt: the distempers wherein it is usually found (as I have often observed) are spitting of blood, Atrophy, or general wasting, and the Hypochondriack disposition.

In the Urines of sick people it is worth observation, whether they dye the Urinal or not? For sometimes in Feavers the urine is no sooner put into the Glass, but presently it darkens its sides with a whitish cloud, and again at another time this does not happen: I suppose that the Glass is dyed, when the liquor of the urine is fuller of dissolved Sulphur than its pores can contain within themselves; as may be perceived in Lye, wherein common Sulphur or Antimony is boiled: Also every urine, if it stand in the Glass till it putrifie, will infect its sides with a crust or cloud, sometimes whitish, sometimes reddish, sometimes of another colour: for the frame of the liquor being loosned by putrefaction, the particles of the Sulphur being loosned from the bond of mixture stick to the Glass: But in the urines of sick people sometimes this presently follows, because the Sulphur is more copiously dissolved than can be included in its pores.

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As to what respects the particular Contents of Urines, they indeed are manifold, and may come from many parts and places: yet they most often depend on diseases implanted about the Reins, Bladder, and Urinary passages: sometimes it happens by reason of an Imposthume in the Liver, Spleen, Lungs, or other Inward; or by reason of preternatural humours heaped up in those places, and flowing out with their fulness, an extraneous matter is transmitted into the mass of blood, and thence into the serous Juyce: but this happens more rarely, because an Imposthume being broken within, for the most part pours out its matter into the cavities of the Viscera, from which there is no passage open into the urinary passages: besides the mass of blood flowing with impurities, does not presently endeavour to send them forth by urine, but oftner by sweat, spitting, breaking out of Wheals, Tumors, or by other ways of excretion. Wherefore it appears by common observation, that the other contents of urines (than which we have above cited) are chiefly sent from the Reins and their dependences; the chief of which are sand, stones, blood, matter, bits of flesh, skins, branny or mealy sediments, which for the most part signify either the stony or an ulcerous distemper, or both together, planted beyond the emulgent Vessels.

It is an usual thing for some to void with their water, gravel or small sand of a red colour in great quantity; some of these are obnoxious to the stone in the Reins, and are frequently tormented with Nephritick fits: I have also known others without pain, or other grievous Symptom, for a long time to make a sandy water. All urines whatsoever, if they stand for some time in a leaded or earthy glazed vessel, affix this kind of red sand to the sides and bottom of the Pot, to wit, the volatile Salt of the urine is coagulated with the fixed Salt of the Metal: so when Sal Armoniac being mixed with the filings of Steel, Sea-Salt, or Vitriol is sublimated, the elevated flours grow notably red: wherefore it seems that these kind of little sands are begot in the Reins, for that the Salt of the urine is coagulated with the Tartarous feculencies laid up about the windings of the Reins, from whence the sandy matter is made, which is presently washed away by the serous Juyce passing through: Therefore the gravel that is so frequently made are no small parts or fragments of a greater stone, (as is commonly thought) but extemporary products of the blood and Serum washing the winding passages of the Reins.

By what means little stones are produced in the Bladder or Reins, is not to be fully discoursed in this place: But without doubt it is done rather by Coagulation than Exsiccation or Excalesfaction, by drying or heating. I have observed some sick of the Stone in the Bladder, who after they have made water, were wont to void with great striving and pain a thick and viscous Juyce, which presently hardened into a scaly matter: the smell of this was like Lye, and of such a consistence as Lye evaporated to a thickness, the liquor of which being made thick, presently stiffens into a saline hardness. Lesser stones sometimes pass through the urinary passages, and are carried out: the greater remain unmoved in their Cells. The places wherein they are usually begotten are the narrow winding bosoms of the Reins, from thence the smaller slide into the Bladder, and if not excerned, they grow into great stones. I once saw many great stones shut up as it were in a Chest about the sides of the Bladder between its Membranes; these without doubt being sent from the Reins while smaller, remained in the passages of the Ureters, creeping between the Coats of the Bladder, and there by degrees did increase in bulk. A Matron so distempered long before her death, cast out of the urinary passage a Membrane thick and broad, full of sandy matter, which (as appeared after her body was opened) was part of the interior Tunick of the Bladder worn and broken by the stones there included.

It is ordinary for Nephritick people, or such as are troubled with the Stone, frequently to void blood or matter with their Urine: for from a greater stone, and endued with sharpness, the flesh of the Reins is easily worn, and the mouths of the Vessels opened, whereby blood flowing out tinges the urine; and when a solution of unity is caused in this manner in the Reins, an Ulcer most commonly follows, whereby matter and filthy stuff are poured out with the serous water, and constitute a plentiful and stinking sediment in the urine: then the sore being more enlarged by the Ulcer, more large profusions of blood often follow, and the flesh it self of the Reins being worn away, and by degrees eaten off, is voided with the urine. I visited once an ancient Woman, who daily voided with her urine, for many months, pure blood in great quantity; besides, as often as she made water, she used to void in great quantity

quantity pieces of flesh, great gobbets, as it were the little Tubes of the Vessels eaten away, that it was suspected one of her Kidneys was all thus cut away from her body: yet afterwards by a vulnerary Decoction acidulated with Spirit of Vitriol, that bloody water was staid, and this Woman lives still well and in health. I knew another Matron, who used for a long time in making water to void at first blood with a purulent matter, and Membranes: then the bloody water ceasing, for many years she made a waterish urine with a copious sediment, and white like snot, sinking down to the bottom of the Urinal. Afterwards when she began to want that sediment, a feaverish intemperance followed with pains wandring here and there, with a languishing of strength, and other dangerous Symptoms: and when this sick Woman was brought into danger of her life, a Tumor arising in her left side about her Reins, and ripening into a Boil or Sore, by reason of the large flowing out of the matter, freed her: but yet an hollow and sinuous Ulcer pouring out a thin matter, remained in that place during her life: and being sometimes healed up, would presently break out again. Scarce two years after this Noble Lady having endured the suppression of her urine for fourteen days, became apoplectick and dyed. Her body being opened, her left Kidney was quite gone, in the place of it a membranous substance growing to the Loyns, infolding the extremities of the Vessels and Ureter, was grown up: some prints or marks of the Ureter remained, but without any opening into the hollowness of the passage: yea a certain ichor or serosity dropping out from the little mouths of the emulgent Artery, was carried outwardly into that sinuous Ulcer. The other Kidney was very full of sandy matter and small stones; besides, near the top of the Ureter a stone about the bigness of ones thumb was fixed, whose extremity was so fitted and firmly impacted to the passage or cavity of the Ureter, that it shut it up just like a Tap, and quite hindered the passage of the serous Juyce. The purulent matter comes into the urine, not only from the Reins, but sometimes out of the Bladder and urinary passage distempered with an Ulcer; and sometimes also a corrupt feed, or white flux, or menstruous blood are poured into urines from the Vessels and genital parts, and produce in them preternatural settlements.

4. In the Urines of sick people are often seen abundance of white Contents composed of most small bodies; which, when they are settled, fill up above half the liquor, and make it white and dusky, the rest remaining limpid, and thin in the upper region of the Urinal: this kind of sediment is called Mealy, because it is like water imbued with meal. Concerning this it is doubtful, whether it proceeds from the whole mass of blood, or only from the urinary Viscera. It appears by observation, that the same sort of urine is always made in the stone of the Bladder, also sometimes by reason of the Kidney being oppressed with some great stone. I never saw such a settlement in urines without a Nephritick distemper; wherefore I have thought it almost indubitable to be always a sign of the Stone: And it seems that it should wholly depend on the juyce or humour heaped up about the bulk or substance of the stone: For where the stone is fixed in the Kidney or Bladder, the nutritious humour is there perverted from assimilation, and degenerates into a more thick mucus, which uses to be copiously heaped up; like Ichor, which by reason of a Pea put into an Issue, runs out plentifully. But this mucus or filth being washed with Serum, makes that white sediment.

CHAP. VI.

Of Judgments to be given concerning the Urines of sick People.

SO much for the Anatomy of Urines, wherein are unfolded their Elements and constitutive Principles, together with their chief Accidents, *viz.* Colour, Consistence, and Contents, both what ought naturally to be in them *per essentiam* or essentially, and also what are wont to happen to them preternaturally, by reason of the body being ill affected. It will be ealie for any one to accommodate this Hypothesis to practice, and to give Judgment on Urines beholding them in the Urinal; for from what hath been said it appears of what parts the Diseases are made known by the inspection of the Urines, and what the Urine signifies in each of them.

Concerning this subject there hath been enough said by Authors ; I shall therefore only touch upon it briefly, and lightly pass it over.

Although the matter of Urine, *viz.* the Serum of the blood washes the whole region of the Body, and is circulated with the blood through all the several parts, yet it doth not lay open the condition and diseases of them all, but only of those to which it owes either the natural perfection and genesis of it self, or from which it receives every alteration : wherefore in some respect it shews the action and disposition of the Viscera serving to Concoction, and besides denotes the temper and motion of the blood and humours in the Vessels : but that any one should pretend to know from the Urinal, and to divine a pain in the Head, an Imposthume in the Throat, or any other Disease of any part, from whence nothing is communicated to the Serum, he shews rather his ignorance than the knowledge of any Disease.

Urines brought from sick persons sometimes are wholly like those of sound people, and then they give no light to the disease or distempered part ; but it may be lawful, having inspected them, to say something negatively, *viz.* that the Patient is free from a Feaver, that as to the Ventricle and Concoction of the food, they are indifferently well : wherefore unless he be inclining to a Consumption, or is sick of an Imposthume, or some other disease of the unity being broken ; whatsoever it be, the distemper seems not very dangerous or hard to be cured.

But in the mean time I would not have him declare any thing rashly, nor proceed farther than he can with safety return : for I have often observed in some most grievous distempers, *viz.* in a malignant Feaver, when with loss of strength, a weak and unequal Pulse, eruption of Spots, and other dangerous Symptoms, the Patients have been desperately sick, that the urines as to the colour, consistence, and Hypostasis, have been laudable, as in sound persons, so that in such a case the Physician by only viewing the Urine, as to his Prognostication had grievously erred : wherefore there is scarce credit to be given to the single testimony of the Urine, unless there be other signs agreeable ; but that it is a lyar in the Plague and malignant Feavers, and deceives : the reason is, that in those diseases the blood is leisurely, and as it were silently corrupted, sometimes without any great fervour : and so, although its liquor be infected by Coagulation, or by mortification or deadness ; yet because it doth not burn out much at the same time, so as to make an heap of adust matter, as of Ashes, the Serum is little or nothing altered from its usual disposition or tenour : Besides, sometimes when in such a sickness the blood grows very hot, whatever of excrementitious is heaped up in its mass, is presently transferred to the Brain and nervous stock : wherefore the serous water being free from preternatural contents, remains after its usual manner ; besides this case, when the Urines appear of a deep colour, troubled, and without any sediment, there is no reason why the Piss-prophet should make a Prognostication.

As often as the Urines of sick people are unlike those of sound, either something natural is wanting, or what is preternatural is added, or it happens both together.

1. There may be wanting Colour, Consistence, Contents, and Quantity. If the Colour be more remiss than it should, and the Liquor paler, it indicates Crudity, and a defect of making Spirits, to wit, that the nourishing Juyce is not rightly concocted or exalted either in the Viscera or in the Vessels ; so that the saline and sulphureous Particles being carried out together, following the distribution as it were the distillation of the Serum, might thoroughly stick to the same, and impart also to it the tincture : wherefore such Urine being viewed from these kind of Symptoms, you may unfitly divine, that there is a weight in the Ventricle, want of Appetite, evil Digestion, a tension in the Hypochondria, an unfitness for motion, sleepiness, difficult breathing, and a frequent palpitation of the Heart upon exercise, a pale colour, a swelling of the Feet and Belly, you may say they are in danger of falling (if not already fallen) into a Cachexy or Dropsie, and if it be a Maid, that she is troubled with Longings and the Green-sickness.

If the Colour of Urines be remitted in a Feaver without a Crisis, it is a sign that the fermentative matter or adust recrements of the blood are separated from the bosom of the blood, and fixed somewhere, which for the most part happens in the Brain ; and for that cause such Urines use to foretel a Delirium or Phrensie ; in those troubled with the Stone, a sudden alteration of the urine into a pale and watry colour, denotes the approach of a Fit.

A copious and pale Urine often shews the too great resolution or melting of the Salts,

Salts, by reason whereof the ferofities are sent away as it were in a flood from the whole body, and chiefly from the nervous parts: such an Excretion sometimes is healthful, and as it were critical, when the superfluities happen only to be carried away: sometimes it is symptomatick, and causes a great debility, to wit, because the nutritious Juyce and the good humours are purged out.

If the Consistence be thin, and the Liquor pale, it argues Crudity, want of Spirits, or too much Drinking, or the Nephritick distemper: if it be of a flame-colour, it is a sign of an intermitting Tertian Feaver.

If the Contents be wanting, and it be pale, want of Concoction is signified, and a Cachectick distemper of the body. But if it be of a Citron colour, and the consistency mean, without Hypostasis, you may suppose the Patient to have used too much labour or exercise; or to be frequently distempered with Sweats in the night, or perhaps to have an Atrophy, or general wasting, or to be inclining to a Consumption.

If the Urine be continually made in a lesser quantity than it should, unless there be a larger transpiration, it is a sign that the blood is not sufficiently purged from the ferous Juyce: wherefore there is a necessity that it become more watry, and that at length a Cachectical disposition of the body, or a Dropsie be brought in. But if it be suddenly suppressed, or made with pain and difficulty, it is a sign of the Stone or Gravel.

2. Something is added to the Urine, to wit, when the colour is heightned, and in the mean time the consistency and contents shew themselves in due measure, there may then be a suspicion of a Feaverish or Hectical distemper: perhaps some evident cause may precede, as the use of Baths, Heat, Surfeit, or immoderate Exercise, which might have heated the blood; or Cold may have heedlessly been taken, whence may arise a shutting up of the Pores, and difficulty of Perspiration. If the urine be of a Saffron-colour, and tinges the Linen with yellowness, you may say it is the Jaundice: but if it be of a Saffron-colour or red without a Feaver, and doth not dye Linen, it shews for the most part the Scurvy or Hypochondriack disposition.

Though the Colour and Hypostasis may be in good order, preternatural Contents are often in the Urine; therefore when it grows cold it is troubled, and makes a sediment sometimes white, and then there is a suspicion of the blood's overflowing with filth, also of an impure Ventricle stuffed with excrementitious matter, or with Worms; sometimes red, which often happens by reason of Transpiration being hindred, a Consumption, and sometimes by reason of a Surfeit, or the beginning of a Feaver.

Preternatural and thicker Contents are sometimes in Urines, shewing themselves naturally, which denotes a distemper of some part about the urinary passages; whence Matter, Filth, Blood, the Whites, corrupt Seed, or the like, are mixed with the Urine: and you may easily know by asking how, and in what place the Patient is ill, what part is distempered; and the straining the sediments of those urines will shew what the disease is, and you may be more sure of the nature of the distemper.

When Urines have stood some time, copious white sediments are thence made; it is not easie at first sight to know from whence they come, *viz.* whether from the whole mass of blood, or only from a particular bowel imployed for the preparations of the Serum or the Seed. For the impurities of the blood and nervous juyce being deposited under a mealy species in the bottom of the Urinal, are wont to cause a suspicion in the Physician of the Whites in Women, and of the Running of the Reins in Men: such like contents are also seen in Urines, which proceed from the urinary and spermatick parts. Amidst these ambiguities, lest you should guess rashly and confidently by the urine, and assert uncertain for certain things, and falshood for truth, the difference of these kind of urines ought to be indicated after this manner. If the contents be universal, and their signs be to be applied to the mass of blood; for the most part these presently after the making (unless sometimes by chance in a Critical separation) are wholly inconspicuous (as in a thinner substance,) then the urine being troubled by cold, they descend slowly to the bottom; and being settled, and the Urinal heated, they disappear again. But if these white settlements are sent from a particular nest, they presently disturb and thicken the urine newly made, are soon precipitated, and vanish not by heat. But that it may appear to what bowel these kind of particular contents should be ascribed, 'tis easily made known to Learned men by other circumstances.

3. The Urine is sometimes wholly altered from the natural state; the colour and contents which should be therein are wanting, and strange things are in their place; then indeed is indicated that there is an intemperance in the whole body, and that the Concoction in the Bowels and Vessels is depraved; you may say the Patient is sick of a Fever; and thence by asking, you may learn and presently pronounce that he is distempered with the Head-ach, Thirst, Heat, queasiness of Stomach, want of sleep, and by consequence with other Symptoms.

It happens sometimes, that the Urine declines from its natural state, yet not to shew the distemper the Patient complains of, but either the cause of the disease, or the consent of some other part with the distempered; as if any one should complain of a cruel Head ach, or trembling of the Heart, and make a watry Urine, that doth not denote those distempers, but only a crudity in the Ventricle, and some obstructions about the Spleen and Viscera, which may be the cause of those distempers: I say in this case, the urine being inspected, the chief indications are taken about the Method of Curing, and we must not use Cephalick or Cardiack Remedies, but either Catharticks, which cause Vomit or Purging, or Openers, and especially Chalybeats: But the urine is sometimes vitiated, and yet its signification is wholly a stranger to the distemper the Patient complains of, as if any one were subject to the sleepy disease, or a Lethargy, and makes it red and full of preternatural contents, its inspection suggests chiefly coindications, *viz.* that we insist not on too hot, but temperate Remedies.

The chief use of Inspection of Urines will be for the observing the state and progress of every disease, as also the alterations towards health or death. For in Chronical diseases, by daily inspecting the urine, is made known to the Physician, by what degrees the sickness may increase day by day; at what time purging or altering Remedies will be most fit, and what Medicines will be most profitable: hence is to be observed, whether Nature prevails on the disease or not; and a most certain Prognostication may be drawn from hence, either of the hope or danger of health; to wit, according as the signs of Concoction or Crudity appear in the Urines. In acute diseases, hence the state and height of the Fever may be best known, at what time the Crises may be expected, and with what success; when it is best to insist upon Evacuations, and when on Cordials. The Compass is not beheld with more certainty and diligence by the Mariner or Steers-man, than the appearances of Urines ought to be observed by the Physician for fit times and ways of Curing.

These were what I had to say concerning the Judgments of Urine, not collected from the vain Traditions of Quacks, but what are consonant to reason and truth. Besides I know there are ordinarily delivered by Medicafters and Old women almost an innumerable company of Rules and Directions of Urine-divination, that the Urinal is no sooner inspected, but they will undertake to divine, whether it be a man or a woman that is sick, how long they have been sick, what their disease is, and whether the distemper shall end in health or death; whether the Patient be subject to the passions of Love or Sadness, whether a Woman hath conceived with Child or not, or whether it shall be a Boy or a Girl, and an hundred other the like; in which using a vain conjecture, they either impose by their confidence on the minds of the credulous, or (which is more frequently their custom) by a cunning craftiness they other ways sift out the matter by inquiring, and falsely ascribe it to their knowledge in the inspection of Urine.

CH A P. VII.

Of the Examination and various ways of proving of Urines.

Although the business of the Examination and Inspection of Urines seems commonly only a simple thing (*viz.* the Medicafters and Quacks for the most part behold the Urine sent in a Glass, shake it a little, and presently give Judgment) yet to those who honestly endeavour the recovery of the sick, the matter seems a little more intricate, and they use to observe several circumstances concerning Judgment by Urine; which being omitted, nothing indeed can be certainly or directly

rectly learnt in the Medicinal Practice from the Urinal. Moreover, in some diseases, besides the mere inspection of the Glass, there are other ways of tryal to be had, by which, what lies hid in the Urines, and out of sight, may be made clear: from whence some not unprofitably taking care of the separation of Urine more accurately, have used to evaporate, distil, putrifie, and precipitate them. Wherefore we shall speak briefly of the right manner of inspecting Urine, and in some cases of the Analysis or separation variously to be instituted.

When the Urine of the Patient is offered to the Physician, if it hath first stood for some time in the Glass, and if the liquor be clear, the Hypostasis as it were gathered into a little cloud, and if the rest of the contents sink down to the bottom, there is nothing more wanting, but that forthwith a prognostick sentence may be given. But if the Urine be newly poured into the Urinal, or be troubled by a former shaking, you must stay till the confused parts be separated, and the settlement have acquired its due place. If the Liquor be full of contents, and the Pores straitned, it becomes troubled and dark, and the Glass must be put in a warm place, till the urine grow clear again; and then let it be placed for some time near the fire, that whilst the preternatural or more thin contents are absorpt by the Pores dilated by the heat, the more thick may fall down to the bottom, and the filaments or little rags making the Hypostasis, (if there be any) may be gathered together below, or in the middle region; for so will appear what is the power of Nature, and what of the Disease: Also in Feavers, the degree of heat and effervescency, the concoction or depravation of the nutritious Juyce, also the congestion or heaping together of the adust matter in the blood, and its separation begun, or wholly frustrated, may somewhat appear by the signification taken from Urines; wherefore you ought to proceed after this manner, when the urine is brought from far, to wit, whose Particles are disturbed by much shaking, unless it be kept for some time in a warm place, they will not easily get again their due place of position. But if you often visit any Patient that keeps his bed, it will be convenient, that the urine newly made, and put into an Urinal, be placed near a Stove, where, whilst it grows moderately hot, the several parts may, after the best manner, be disposed to a settlement without any trouble or disturbance.

Afterwards the Urine thus naked, and as it were disrobed from any covering, is offered to the sight, the next caution will be, lest any of its Phænomena or appearances being accidentally contracted, and not properly belonging to it, may impose upon the Physician: which indeed sometimes happens, by reason of alterations caused in them by food taken, and which chiefly consist in the colour and smell of urines, being variously changed besides Nature, and the expectation of the Physician.

For it is an error commonly committed, when the Urine being yellow, and tinging the linen by the taking of Rhubarb, Saffron, Sanders, and the like, undoubtedly to believe it a sign of the Jaundice; also the urine being imbued with blackness by the taking of Cassia, to attribute it to the melancholick Tumor or blackBile; also when the urine is deep colour'd by taking of Pulse-broth, or a Decoction of Madder, or other drinks, we falsely suppose it to indicate a feverish intemperance. It often happens from the drinking plentifully thin liquor, the urine is lessened of its high colour beyond expectation, and heightened by the drinking of strong drink or hotter things: unless the Physician take notice of these kinds of mutations, he will give but a false Judgment concerning Urines by looking on them. When therefore the colour is changed in the urines without any manifest cause, the manner of living must be inquired into, if that the alteration proceeds from what is eaten or drunk, that it may not be wrongfully ascribed to the disease. A question will here arise, why forasmuch as most things taken in at the mouth, before they go into urine, wholly lose all their colour; yet some others, which being eaten, so pertinaciously impress a tincture to the Serum, that they pass untouched through all the strait turnings and windings of the passages? The reason or cause of which consists chiefly in this, that some mixtures have the constitutive parts of their colour or dye very subtil, and those highly volatile; wherefore these being taken only in a small quantity, dye the whole mass of the Chyle with their colour; and from thence the nutritious Juyce conveyed to the blood, ascends coloured, and its vehicle, *viz.* the serous Latex, is sent away still dyed or tintured.

What the odour of Urines of sound people may be, is obvious to every one that can smell, *viz.* whilst it is fresh made, it is not very ungrateful, by reason of the sulphureous and saline Particles bound up in the substance of the liquor; when it hath
stood

stood so long, that the Sulphur begins to exhale, sharpened with the Salt, the mixture being loosened, it putrifies and stinks grievously. Besides we may observe, that sometimes there arises from urines fresh made, a sweet odour like Violets, and sometimes they offend the nose with a very ungrateful stink. The former doth not depend either on an healthful or unhealthful condition of the body, but is produced only from things taken: Turpentine, Nutmeg, and other Gumms and Spices taken in at the mouth, though of a diverse nature and operation, impart a like suavity or sweetness to the urine. The reason of this seems to be, because in these kind of mixtures very many particles of the purer Sulphur (that is imbued with Spirits) are eminent; which, for that they are volatile, being confused with the Serum, are not contained in the bond of the mixture: wherefore the urine being made, these alone leap out, and not accompanied with others of the stinking urine, and so diffuse a grateful odour; which, although it proceeds from divers kind of things eaten, yet remains still after the same manner like Violets, for that in all, those sulphureous Particles are set free by digestion from the others joyned with them in the same concrete, nor are infected by different ones from the urine. But as to what respects the stinking urine, that sometimes proceeds from an Ulcer about the Reins, Bladder, or urinary passages; sometimes also it is raised from a too hot intemperance of the Reins, or of the whole Body: for when the Sulphur is deeply boiled in the Serum, its particles being sharpened by the Salines, (for that they are less closely shut up) do presently evaporate, and grievously affect the sense of smelling; but besides, sometimes urines contract a stink from things eaten. For the Balsam of Sulphur, Garlick, Asparagus, Cider, Rhenish Wine, and many other things taken at the mouth, do cause a strong smell in the urine. If the reason of this be demanded, we say that such things which impart a stink to the urine, also provoke it in a more plentiful quantity: wherefore it seems that these sort of things being taken, fuse the blood, and greatly hasten the precipitation of the Serum: and when by this means the serous Juice is pulled away as it were abruptly from the blood, the frame of the liquor is made lax, nor are its parts exactly mixed, nor contained in an equal bond of disposition: wherefore when this urine is made from the body, its frame or substance being before loosened, the particles of the more gross Sulphur (that is combined with Salt) presently breathe out, and so diffuse a stinking smell. For urine thus altered by things taken, seems very like to Lye, wherein Antimony or common Sulphur is boiled, and is afterwards instilled into some acid thing, because in this Decoction, as also in such urine, the frame of the liquor being unlocked, the little sulphureous bodies leap out, and affect the sensory with a stinking smell.

If that any one more curious in the search of Urines, shall seek further than the examination of the sight and smell, he may easily, by a divers manual operation, resolve them into parts, and as it were dissect them to the life, and thence draw Medicinal directions of no small moment; for that in many Chronical diseases where the Dyscrasies of the blood are more exactly to be sought into, that the proportion and temperature of Salt and Sulphur may be truly found in it, it is sometimes convenient to evaporate urines, or to distil them; something also is to be learned from them, being precipitated, or loosened by putrefaction. I knew an honest Woman greatly afflicted with a scaly filthiness of the skin, which she was daily wont to scratch off in great plenty, as it were a branny matter. Her urine being evaporated in a little Skillet, left sticking to the sides of the Vessel, a crusty and salt sediment, like the excrement of her skin. Not long since I evaporated the urine of a Gentleman, grievously subject to convulsive motions and painful stretchings out of the Muscles, in the bottom of which there remained a quantity of salt and tartarous matter, exceeding the weight of half the liquor. By this means it will be an easie thing to find the proportion of the saline Principle in the blood and humours: but whether this Salt be volatile, or becomes fixed beyond measure, the distillation of the urine will presently shew: For if the Spirit (so called) be copiously drawn out of the urine, and that besides the Salt ascends into the Alembick, it is a sign of volatilization: but the contrary to this argues the fixity of the Salt.

As the evaporation and distillation of the Urine shew the power of the saline Principle, so the precipitation, putrefaction, and Sulphur lay open the thicker contents of the Urine, as it were in weight and measure. As to the former, although the liquor of the urine be salt, and often big with contents, yet for as much as its saline Particles are not (as it is wont to be in most Menstruums) either wholly in a state of fixity,

fixity, or of flux, but for the most part volatile, therefore it is not easily nor presently by any salt infusion subject to putrefaction; the Spirit of Vitriol and other acetous things effect nothing: the Salt of Tartar stirs up a little perturbation. But the solution of Alum, for that it greatly constrains into a little space, presently disturbs the whole liquor extremely, and delivers all the contents of the urines, as they were thrust out of their dens, to be seen openly by the eyes. Wherefore by this means, without any long stay for settlement, you may presently know how much of sulphureous and earthy matter is deposed from the mass of blood for recrements in the bottom.

The putrefaction of Urines is wont to exhibit the several particles of every kind, yet more distinct, and disposed as it were by themselves; for if the urine be left to stand unmoved for many days in the Glass, the colour, odour, and consistency will be very much altered, for the colour will be deeper, the smell ungrateful, and highly stinking, the consistency thicker, and will have on the superficies a downiness or hoariness, sometimes whitish, sometimes bluish; there will be also fixed in the bottom of the Vessel a thick and copious sediment, and often on the sides a sandy or tartareous crust, of a whitish or Ash-colour. From these kind of appearances, and as the urines sooner or later putrifie, and so are more or less altered from their former state, it may be conjectured what the proportion of Salt or Sulphur may be, whether of them exceeds the other: also no unfaithful Judgment of the quality and plenty of the earthy matter or the contents may be taken from hence.

And thus, Sir, at length you have the Doctrine or Method of Separation of Urine, such as our unskilfulness hath rendred it: I desire you would be pleased not only to pardon the errors and barrenness of this Discourse, but also to excuse it in other things, because at first writ by your perswasion, and then by your command and request made publick. Wherefore pray take care of this child hardly brought forth and almost an abortive, and as it were exposed and deservedly laid at your door, without portion. Farewel.

Two Physical and Medical
EXERCITATIONS,
V I Z.

- I. Of the Accension of the Blood.
 II. Of Musculary Motion.

The first Medical and Physical
DISCOURSE.

Of the growing hot or inkindling of the Blood.

IT is long since I designed to print my Meditations concerning the remaining Pathology of the Brain and Nervous stock : But when many Diseases of that kind affect the animal Spirits, and not rarely the whole Hypostasis of the corporeal Soul more immediately than the Humors or solid Parts ; I therefore thought it necessary first to publish the Disquisitions of the nature of this Soul, and its manner of subsisting, and also of its Parts and Powers, that from these things rightly known, its preternatural Passions may at length be the better discovered. But concerning these very hard matters, and difficult to be unfolded, when I had begun to frame (as I think) probable and rational Arguments, I saw well that they would be looked upon and laughed at by some as unusual things and Paradoxes ; which indeed it becomes me not to take ill, but to let every one freely to enjoy his own sense, and to use in all things his own opinion and judgment. Among the many things conjecturally proposed by me, (which I could not avoid) two chief Arguments are opposed, to wit, that I had affirmed, that the blood for the continuing of life was inkindled, and that the animal Spirits, for the motive act, were exploded: which terms, though perhaps they may sound rough and strange to be applied to the animal œconomy ; yet if any one shall weigh the Reasons and Arguments which do perswade to the truth of either opinion, I doubt not, but that there will be none who will not give their assent, or easily pardon me for mine. In the first place therefore, because there are so many opinions concerning the growing hot of the Blood, for that some attribute it to an innate heat, others to a flame in the Heart, some also to a fermentation of the bloody mass, and others to its inkindling ; therefore I shall endeavour more narrowly to introspect the matter, and as much as I am able, to build upon a more certain Ratiocination, its genuine Cause, though very abstruse.

We have formerly discoursed concerning that Soul, which is common to the more perfect Beasts, with that subordinate or more inferiour of Man, and have shewed it to be indeed Corporeal, and to consist of two parts ; the one of these rooted in the blood we called a Flame, and the other dwelling in the Brain and nervous stock, Light. As we shall here only treat of the former, I think it will be no difficult matter to make use of the same Reasons and Instances, which truly conclude, or at least very like truth, that in the first place the blood is animate or hath life : secondly,

ly, that this Animation is in its accension or inkindling, or consists in an affection most analogical to this.

1. Not only the opinions of Philosophers, but the undoubted testimony of the Sacred Scripture plainly asserts the animation of the blood: to wit, the use of blood was forbidden in the Mosaical Law, for this reason, because the Blood is the Life or Soul; which is also apparent by the observation of the most famous *Harvey*, for that its motion is to be observed by the eye, shews that it first lives and last dyes. For the greater proof of this, it is commonly known that Animals only live so long as the blood remains in its due plenty and motion; and that they presently dye, if either too great a quantity of this be taken away, or its motion suppressed.

But as to the second Proposition, to wit, that the life or soul of the fervent blood depends upon its inkindling; this will appear probable, if I shall shew: First, that the liquor of the blood ought to be very hot in the more perfect living Creatures. Secondly, that this growing hot can be produced or conserved in the blood by no other means besides accension or inkindling. Thirdly, that some chief affections, as it were proper passions of fire and flame, are agreeable to the life only of the blood growing hot. Fourthly and lastly, these being clearly shewn, some other less signal accidents and properties, in which common flame and life agree, are added, and also we will unfold how and in what respect they differ among themselves.

As to the first we affirm, that the blood is perpetually moved in all living Creatures; besides in the more perfect it doth estuate or grow hot in act. Indeed its undiscontinued motion is required, both for the conservation of the disposition of the blood it self, whose liquor would otherwise be subject to stagnation and putrefaction, as also that being carried about in the whole body, it might be able to give a due tribute to all parts. For that the offices of the blood, at least in the more perfect living Creatures, are divers and manifold, *viz.* to instil matter in the Brain and nervous stock for the animal Spirits to dispense the nutritious Juyce into all the solid parts, to suggest to the motive parts an elastic Copula, and besides to separate all recrements and worn out Particles, and to put them aside into convenient Emunctories.

But although the mere motion of the Blood in less perfect Animals, or at least its moderate swelling up, such as may be perceived in Wine and other Liquors agitated into Fermentation, is able to sustain and perform the œconomy of Nature; to wit, for as much as both a crude nutriment is every where received from the river of the blood, though cool, continually flowing into all parts of the whole Body, and that fewer spirits and more thick, as it were separated by percolation or straining, enter the Brain and nervous stock with that plenty, that may suffice for local motion, and the Organs of the few senses to be rudely actuated: yet the blood watering the bodies of more perfect Animals, require offices of a far more excellent kind; for it ought not only to be carried about with a continual and more rapid motion, but very much to swell up, yea actually to grow hot or effervent: to wit, for that end, that its frame or substance being very much loosned, it may more copiously send forth the respective Particles of various kinds, every where falling off from it, and may dispose them here and there for the use and wants of Nature.

But first, for that the animal Spirits are continually to be supplied in great plenty from the mass of blood, and that there is need for the elastic Particles requisite for the locomotive function, to be thence perpetually poured into all the Muscles, it seems very necessary that the liquor from whence these generous and manifold supplements are drawn should be actually hot, or rather should burn forth; to wit, that the aforesaid Particles, not sufficiently to be unlocked but by heat or burning, should freely run out from the substance or frame of the liquor: which truly is manifest, because from Wine, and also from the same bloody Liquor, and all other spirituous things, a subtil and spirituous humour is copiously drawn, but not to be performed by distillation without heat or fire. Yea the sulphureous Particles, although they are less apt to be exhaled from any Liquor, yet they most readily fly out by inkindling the subject. By these there is an apparent necessity of the blood's growing hot for the perfection of the animal as well as vital function; but that it may appear by what means this is done, to wit, whether by Accension, or by Fermentation, or by any other way, we shall first in general inquire, by what means, and for what causes any liquid things are wont to grow hot; then we shall consider, to which of these the growing hot of the blood ought to be attributed.

Concerning these we say, that there are only three ways, or so many kinds of causes, by which Liquors conceive a heat, *viz.* first, by fire or heat being put to them, as when water is made to seeth or boil over the fire, or that it grows hot by the heat of the Sun, a Bath, or Stove, or by the dissolution of quick Lime; instances of all which are commonly known. For the same reason Bath-waters seem to boil. For, that we may instance in our own Baths, to wit, they are impregnated neither with Sulphur nor fixed Salt, as I have plainly experimented, by distilling and evaporating them, and by pouring into them precipitating Liquors; yea by dissolving them with Sulphur, and many other ways. They most resemble Lime-water, and they, as we believe, grow hot from a like cause, to wit, by imbibing the fiery little bodies somewhere hid within the Earth. Of these, unless it had been superfluous, we had here given a fuller description, which may perhaps be done at some other time. Secondly, when saline Corrosives, which are of a diverse kind, being mingled with themselves, or with sulphureous things, work mutually one on another with a great strife and agitation of Particles, and oftentimes excite heat, yea sometimes fume and flame; as when the Spirit and Butter of Antimony are poured to, or mixed with stygian Water, wherein lixivial Salts are melted, or with Oyl of Turpentine, or other distilled things; besides when corrosive Liquors eat metallick Bodies, they often grow hot. Thirdly, and the only way besides (as I suppose) whereby a liquid thing is made hot, is when any humour, being very much imbued with Sulphur or Spirit, conceives a burning by putting a flame to it, and so grows hot by burning forth. This is ordinarily seen in oily or very spirituous Liquors, being in-kindled and inflamed.

There remain indeed some other ways of Calefaction, to wit, Fermentation, Putrefaction, and Attrition, whereby more thick Bodies, or Solids, often conceive a fervour, but they produce not such an effect in Liquids: whilst the mealy Mass or Dough is fermented, the active Particles being stirred up into motion, unfold themselves on every side, and lift up the bulk or substance of the subject; in the mean time, for as much as the sulphureous Particles being agitated with them, take hold one of another, and begin to be combined, a certain heat, though more remiss, is excited; in like manner from Putrefaction, Dung or wet Hay get an heat, to wit, for as much as the sulphureous Particles, within included, are very thickly heaped up together, then being combined together, they break out in troops: yet no Liquors, either thin or thick, whether they ferment or putrifie, do for that reason at any time grow hot: For Wines, whilst in fermenting they break in pieces the sides of the Tun, or overflow the top of the Vessel with a great noise and ebullition, do not actually grow hot, yea not so much as grow warm. The blood being let out of the Body, and placed in convenient Glasses, either to ferment or putrifie, doth not get any actual heat: yet in truth we grant the Blood in living Creatures to be fermented, and by fermenting to be putrified, yea and some other offices of the animal oeconomy to perform the same: moreover, we have formerly shewed from its Fermentation being hindred, or too much increased, or otherwise depraved, divers kinds of diseases to be produced: yet we deny the heat of the blood to be excited by Fermentation. Because neither the blood of more frigid Animals, nor Wines, nor any other Liquors, though agitated with the highest Fermentation, are for that reason actually hot. And indeed the reason seems evident enough, to wit, because the sulphureous Particles being raised up in the more thick subjects, though they lay hold on one another mutually, and being more thickly heaped together, raise up heat: yet in Liquids, the same kind of Particles, however stirred up or agitated, are immediately disjoyned by the watry coming between, and are hindred from their mutual embrace and combination; so that they cannot of themselves produce an actual heat: For the same reason, hard Bodies being rubbed one against another, or violently knocked or bruised, do not only produce heat, but oftentimes fire; whenas yet Liquids, however shaken and agitated, do not grow warm. Therefore as there are only three ways, whereby actual heat may be begotten in all Liquors, we shall inquire to which of these the heat of the Blood may be ascribed.

First, Some say it is the first way, from the opinion both of the Ancients, and of some of the Moderns: the Blood is said to grow hot, by reason of some hot thing put to it, to wit, whilst those affirm an innate heat, and these a little flame to be placed in the Heart, and to heat the blood passing through it; but either of these opinions easily fails, from which it is clear, that the Heart is a mere Muscle, nor doth contain

contain in it self any tinder or matter for a flame or heat (I know not how) implanted, fit for their continuance. For though it be confessed, that on the continual motion of this Bowel, (which is only animal) the Circulation of the Blood doth depend, yet the Heart borrows heat altogether from the blood, and not the blood from the Heart.

Secondly, As to what respects the second way of making hot a liquid thing, to wit, whereby a great heat is excited by the mixing of saline Corrosives together, or also oily, or by corroding a metallick Body, I think there is none that will seriously assert, that the blood grows hot from such a cause; for that its liquor, in its natural state, is always homogeneous, and although it be stuffed with plenty of Salt, it is however with that which is volatile, gentle, and benign only: But there is not to be found, either in the Heart, or in any other place a saline or any otherwise heterogeneous Mine, whereby the bloody liquor, by working or corroding, may get or conceive an heat: to wit, it behoves either such a Mine or the Body to be corroded, to be perpetually renewed, because the ebullition and heat raised up by the strife of Salts, ceases as soon as the Salts are combined, or the Body corroded. If at any time the saline Particles of the humours in our Body depart from their right temper, and become enormous and unbridled, for that reason the blood, as to heat and motion, enters into some irregularities; yet it seems impossible, that it should originally and perpetually become hot by the congression, and strife, or corrosion of the Salts.

Thirdly, As to the third way, whereby Liquids are made hot, though it may seem an uncouth saying, That the blood is so inkindled, yet since we cannot attribute it to any other way besides, what should hinder from attributing its heat to this Cause? And the rather, for that the proper passions of Fire and Flame are agreeable to the life of the Blood alone.

For indeed these three things are chiefly and principally Essentials, requisite for the perpetuating flame. First, that there be granted to it, as soon as it is inkindled, a free and continued accession of the Air. Secondly, that it may enjoy a constant sulphureous food. Thirdly, that its recrements both sooty, as also the more thick, be always sent away. So then if I shall shew these things to agree after the same manner with life, as flame, and to those only, without doubt, I think that life it self may be esteemed a certain kind of Flame.

In the first place therefore, that a flame may be inkindled, and remain inkindled, there is need of a free and undiscontinued access of Air, and that not only, that the vaporous Effluvia's, threatening the suffocation of the flame, may be carried away, and always depart, but much rather, that the nitrous food necessarily requisite for the burning of any thing, may be supplied by the Air. For indeed every sublunary fire, and especially flame, is compounded or made up altogether of sulphureous Particles, breaking out in heaps from a combustible Body, and of nitrous Bodies, which every where flow in the Air, meeting with them: when Particles of Sulphur, breaking out slowly or interruptedly, get to themselves a few nitrous, only planted near them, a fire is usually produced, such as is seen in a burning Coal: But when the former going away more impetuously, either of their own accord, or forced by blowing, presently lay hold on very many nitrous Particles flowing round about in the whole circuit, a flame arises. In truth the whole region of the Air is abundantly stuffed with nitrous little bodies, which are every where ready for the constituting of fire and flame, and they being any where inkindled, meet them after the manner of a flood, although not always after the like manner or measure, because it is observed at some times, especially in the Winter-cold, when the Air abounds more in Nitre, that fire or flame doth more ardently burn, and diffuse farther its heat: on the contrary, in rainy weather, as also when the beams of the Sun shine upon the fire, and so dissipate the Nitre of the neighbouring Air, the fire is so dull'd, as is commonly said, that it is extinguished by the Sun. If at any time the nitrous Particles of the Air are excluded from the sulphureous of any subject breaking out in the inkindling or burning, the fire and flame quickly perish; which appears, because this or that being put into a Glass, after the Air is sucked out or excluded, they presently expire. Further, in the open Air, although a naked fire propagates a fire in a fireable matter by mere contact, yet a flame is hardly inkindled without a flame be put to it, or a very strong fire: because, for the stirring up of a flame very many nitrous Particles of the Air, implanted round about, ought to be inkindled at once; as if Nitre and common Sulphur being pound-

ed together, be commixed (because both Incentives agree) even the least spark falling into such a mixture begets an highly impetuous flame, which desiring no farther a nitrous food, is inkindled or burns under water, in a place void of air, or in any place as freely as in the open air. In like manner the least sulphureous things, as a bit of ponderous wood, being cast into a red-hot Crucible, in which Nitre is fused, the same at first touch presently conceive a flame, and continue till it be wholly consumed: But that fire and flame being included in a place empty of air, expire by reason of the food of Nitre being drawn away, rather than choaked by their own proper smoke, the Illustrious Mr. *Robert Boyle* hath most clearly demonstrated by very many Experiments. For a Candle being lighted, and put into a capacious globe of Glass, and the Vessel stopped up: as soon as the air was sucked out by a wind-instrument, the flame did expire. Moreover he observed, what concludes for our Hypothesis, that the flame contracted it self according to all its dimensions, as soon as ever the Engine began to suck, then after the second or third draught of the drawn forth air, the flame about the utmost extremities appeared very blue, and to go back more and more from the Tallow, till at length getting to the top of the snuff it expired: the same Candle being again lighted, and shut up in the recipient, this worthy Gentleman tryed how long it was able to sustain its light, when the air was not exhausted, and he found it to endure much longer lighted than before. From these it clearly appears, that the flame shut up, expires not so much because it is suffocated by its own proper smoke, as because it is destitute of the nitrous food of the Air. For in the former Experiment the air being exhausted, there was more space for the smoke and fume, that the flame might not be stifled, and yet this dyed sooner, the Recipient being empty, than the same being full of air; besides, the flame dying became bluish, for as much as it participated of more Sulphur than Nitre; and it left the Tallow, and expired at the top of the snuff, for that it followed its most necessary food as far as it was able, to wit, the nitrous Particles of Air. The same Experiment succeeded alike in live Coals, viz. the naked fire, after the food of Nitre was drawn away, suddenly dyed. Here also it doth what the flame of a Candle doth in Mines or Caves under ground, where the nitrous air is wanting or dispelled, at first it becomes more contracted and blue, and then a little after expires.

I have been more large in this Argument, because there is for both the like necessity of drawing in of the air, after the same manner, for the sustaining the life of the Blood, and for the continuing of flame. For the more hot Animals, if they are hindered from respiration dye quickly, wherefore the same means of killing is most ready and common to shut up the breath, which being wholly obstructed, life perishes as a flame. If it should be objected, that those choaked do dye, because the soot or smoke being retained, blow up and intumesc the bloody mass, which for that reason, the bulk or substance being increased, and made almost immoveable, fills the bosom of the Heart, and hinders its motion: I say, that this is improbable, because if the Arteries, every where in the Limbs and about the Neck, be strained hard together with Ligatures, that the blood being straitned as to the compass of its circuit, be very much stopped about the Præcordia, (more certainly than can happen from the mere retained smoke) yet for that cause death neither presently follows, nor any deadly Symptoms. That this happens in those that are hindered from respiration, because the vital flame of the blood is wanting of the nitrous food of the Air, rather than overthrown by its proper soot or smoke being detained, the most Famous *Boyle* also by his Experiments hath put it out of doubt; for he hath observed, that hot living Creatures being put within a glassy Globe, and shut up, did far sooner expire, the air being drawn away from them, than the same being left within it, though in the former case, there was more space left for the receiving the smoke, lest the retaining of it might constipate the blood: yet however, if the heat of the blood should arise from Fermentation, or the congression of dissimilar Particles, or from an ebullition, by reason of admitted heat, or from any other cause besides accension, it is so far that that effect could be inhibited or suppressed by reason of the air being excluded, that on the contrary it would rather for that cause become more strong or intense. For it appears, by a common observation, that Liquors chiefly fermentable, the more strictly they are kept in the Vessel, the more they grow hot, and the air being admitted through some vent-hole, they presently cease from their fury. Moreover, Mr. *Boyle's* Experiments clearly shew, that the effervescencies or growing fervent, stirred up by the ebullition of unlike Particles, or by corrosion, also the boiling up of hot

Exper. Phys.
Mec. 50.

Exper. 13.

Exper. 78.

Exper. 41.

hot water in a glassie Sphere, are above measure increased after the air is sucked out, *Experiment. Physicom.* 41, 42, 43. That most ingenious Tract of the aforesaid Author supplies us with many Experiments, whereby it is abundantly manifest, that the intestine motions of those Particles, and almost of every thing, besides fire and life, are very much heightened or made strong in the space emptied of air; but their act, presently after the air is withdrawn, is extinguished: hence we may conclude, the life of a living Creature to be either fire, or something analogical to it. The like to these is yet more clearly observed by the diggers of Minerals, who ordinarily experiment in subterranean Caves, where either the Nitre is wanting, or is driven away by some strange damp or vapour, so that they are in danger of being stifled or smothered, at the same time the flame of the Candle is diminished, becomes blue, and at length expires.

The second thing requisite to sustain a flame, is a constant supply of sulphureous food, whereby it may continually be fed, which being subtracted, or by reason of some incongruous mixture depraved, the flame is extinguished; as is perceived in a Lamp, which for want of oyl, or water poured in its place, expires: further, as this sulphureous food is more or less suggested, sometimes more plentifully, sometimes more sparingly, the flame being more or less intense, is sometimes produced clear, sometimes smoaky; in the mean time, the food being constantly consumed by burning, goes away partly into vaporous Effluvia's, and partly into ashes, which are made up of some Particles of Earth, Salt, and Sulphur: But it is much otherwise in Liquors exposed to Fermentation, to which if new Particles be continually administered, and the old ones depart, the Fermentation is hindred or disturbed.

In like manner, as in Flame, the Blood of the hotter Animals (and this only in all natural things, besides fire) requires a constant and copious sulphureous food; and that being quickly worn, is for the most part consumed in vaporous Effluvia's, a *Caput mortuum* being left of Earth, Salt, and stinking Sulphur: In the mean time from its food consumed by burning, it disposes other Particles for other uses. That the life or flame of the blood doth continually want aliment, there is none but daily finds it in himself: For if that be for some time denied, the vigor of the blood is diminished, yea and consuming the solid parts, it snatches into its bosom their remnants, and other humours of the Body whereby it may be fed. If the nutriment daily suggested from things taken, be too thin and watry, the fervour of the blood, like flame without food, uses to be remitted; but if the food be very sulphureous and swelling with a vinous Spirit, and plentifully taken in, the blood is presently inflamed, and often breaks out into a Fever, as it were an open burning. In the interim out of that food of the blood exhausted or consumed, as it seems by accension, hot Effluvia's full of foot and vapour go away, which according to a just account, far exceed all the other excrements of the Body; and that their nature is plainly fiery, the frequent burning of the mouth and tongue, and infecting them with blackness like the soot or smoke of a Chimney, witnesses; besides, from the inflamed blood adust Feces, like a *Caput mortuum*, are sent into the Bladder of the Gall, Spleen, and perhaps into other Emunctories.

Thirdly, That inkindled Flame may for some time continue, there is need of continual ventilation, to wit, that its footy Effluvia's may still fly away, which else being detained and heaped together thereabouts, will suffocate the fire, because by obstructing the Pores of the inflamed Body, they hinder the eruption of the sulphureous matter to be inflamed. Although this condition doth often interfere with the other more potent, *viz.* the necessity of nitrous food to be so drawn in from the air, that it can scarce be distinguished from it; yet we may plainly perceive, from the detained foot gathered together about the snuff, the light to be put out: for which cause a Lamp, whose wick is made of plumous Alum or other incombustible matter, will not (as it promises) endure any long time, because the foot sticking to the wick, hinders the access of the oyl to the flame; for this reason blasts of wind from the Air wiping away the footiness, doth not only render the flame more clear, that is free from fume and thick vapour; but food being sufficiently given to it, it becomes more durable.

Even as Flame, the life of the Blood requires also continual ventilation; to which end, besides the greater breathing places of the Breast, innumerable lesser, *viz.* the Pores of the skin gaping every where through the whole Body, do send forth Effluvia's departing plentifully from the boiling blood; which if it happens to be hindred,

or too closely shut up, the blood will grow excessively hot, being as it were beset with fume and vapour: besides, there is need to shorten its circuit, that passing through the Lungs with a more frequent turn, it might there, as much as it can, dispel all its soot or smoak. When the Heavens are heated, the Air seems as it were immoveable and to stagnate, we are wont very much to estuate or grow hot about the Præcordia; for that the blood being fed with a more sparing nitrous food, doth not burn so clearly, but glows with a more suffocating and intrinsic burning: further, for that the Particles of the Air being less nimble, when they are inspired and expired or breathed forth, do not so readily convey away the vaporous Effluvia's of the blood; hence it is, that we fan the Air, that it may be made more moveable, and carry away more quickly and plentifully the soot or smoke from our Præcordia.

There yet remain some other smaller Considerations of Fire and Flame, respecting indeed not so much the Essence, as the production and extinction of either, which, whether and how far they may agree with the life of the Blood, we shall briefly inquire into.

Fire or Flame is produced two ways, *viz.* either it is kindled from another fire or flame, or begot by an intestine motion of sulphureous Particles. We have largely shewed the Species of either, and the manner of their being made, in our Tract of Fermentation (only we omitted there, that the accession of nitrous food was necessary for the sustaining it) even as flame, the life also of the hot or warm Blood, we have observed to be produced by a twofold way, to wit, it is either inkindled from another life or soul, as in Creatures that bring forth alive; or intrinsic Particles predisposed to animation, are at length raised up to life with the blood by a long cherishing of external heat, as in oviparous or egg-laying Creatures.

If it be further demanded, when and how the vital Flame is kindled first in the Blood? I say, some small beginnings of it are laid up from the conception it self in the Genital humour, to wit, when the rudiment of the bodily Soul culled out from the Souls of the Parents, as a little spark stricken from those flames, is hid in a convenient matter; which being from thence raised up by the Mothers heat, begins a little to glow and shine, and afterwards being daily dilated with the blood brought forth, and leisurely increased, is equally extended with the Body, which it actuates and animates. But yet as long as the young one is included in the Egg or Womb, the vital fire, getting very little or scarce any aery food, doth not yet break out into open flame, but like a Brands end covered over with ashes, burns only slowly and very little, and spreads abroad scarce any heat; wherefore both the formation and increase of the Embryo depends very much on the Mothers heat, or the cherishment of some other analogical thing, whereof being destitute it perishes: but as soon as the young one is born in due time, and begins to breathe, the vital fire presently receiving the nitrous food, largely unfolds it self, and an heat or effervescency being raised up through the whole bloody mass, it inkindles a certain flame; and because the blood then first rushing into the Lungs, having there gotten an accession of Air, begins to burn, the flesh of that Bowel, at first reddish, is shortly changed into a whitish colour, like burnt ashes, and the blood it self undergoes a notable alteration; for what did flow of a dark Purple colour into the Pneumonick Vessels from the right side of the Heart, returning from thence presently out of the Lungs, becomes Crimson, and as it were of a flame-colour, and so shining, passes through the left Ventricle of the Heart and the appending Arteries.

Indeed that in Creatures new-born, the colour of the Lungs is so suddenly changed, I think it ought to be attributed to the blood, there at first more openly inkindled, and their flesh as it were somewhat roasted; although the mere inflation of the Lungs in a dead Embryo produces the like effect, because the Membranes of the Lungs and the Parenchyma being distended and increased into a greater capacity, shake off the stagnating blood, and so draw it away into little and scarce to be discerned rivulets.

As to the Colour of the Blood, so variously changed into circulating from a dark purple to a crimson, and from this to that, I say, that the immediate cause of this is, the admixtion of the nitrous Air with the Blood; which certainly appears, because the change into a crimson, begins in that place where the blood chiefly gets the access of the Air, *viz.* whilst it is transferred out of the Arteries into the Pneumonick Veins; for in those it appears of a dark Purple, in these every where florid, as the most Learned Doctor *Lower* hath observed. Further, it yet farther appears, that

that this alteration of the colour proceeds from the admixture of the Air, because that crimson colour follows in the superficies of all blood, let out of the Vessels by reason of its meeting or mingling with air; and if the flowering or top be taken away, another presently arises. Besides, the blood being let out of a Vein, and very much struck with a switch or rod, it becomes crimson through all: and in like manner the blood of living Creatures shines at first within the Pneumonick Veins, to wit, presently after the influx of the air by the Wind-pipe; and from thence, by reason of the same Particles of inkindled air being yet retained, it passes through all the Arteries still florid; in the mean time, from the Nitre of the Air mingled with the sulphureous Particles, and burning with them, the blood being greatly rarified, and in truth expanded into flame, impetuously swells up within all the passages of the Pneumonick Vein and the great Artery, sending from it self copious breaths and hot Effluvia's; but being dilated towards the ends of the Arteries, and returning towards the Heart, that it may enter more closely into the little mouths of the Veins, it lays aside its turgid and burning aery Particles, and being presently made more quiet and half extinct, and so both its vigour and also its colour being changed, it returns through the passages of the Veins, that at length running into the Lungs, it might renew its burning. After this manner, that the inkindled blood might flame through the whole Body with a perpetual and equal flame, and successively renew its burning in all its Particles, it ought to be carried about by a perpetual course from the nest of its accension into all parts, and from these to that. For this end the Machine or Engine of the Heart was needful, as a Pin or Cock, which being made with a double bosom, might receive in it self from the whole Lungs the blood fresh inkindled, that it might presently drive forward, whilst burning, into every part of the whole Body, and might then receive the burnt and half extinguished blood returning from the whole Body; which being imbued with new inflammable juyce, it might deliver to the Lungs to be re-inkindled.

In performing this task, although the Heart be a mere Muscle, and exercised only with an animal motion, seems to serve alone for the Circulation of the Blood; yet in the mean time, it so much helps to moderate the accension of the blood and its burning, according to the rage of the passions, and to direct other works and uses of the animated Body, that we have thought the vital or flamy part of the Soul to have its chief, and as it were Imperial seat in the Heart and Lungs; in every distemper or affection, as of Grief, Joy, Fear, and the like; also in the fits of Diseases, the Heart is disposed after a various manner, and hence it comes to pass, that the blood flowing in fluctuates, and is inkindled with a diverse rage; of which there will be a more opportune place of discoursing, when we shall treat of the Passions.

Whilst we consider that the burning of the Blood, and for that reason the vital or flamy part of the Corporeal Soul doth not appear lively or vigorous in all, nor ever after the same manner or measure; yet it exists according to the various constitutions of the blood, to wit, as it is more or less sulphureous, spirituous, saltish, or watry, yea and according to the divers constitutions and conformations both of the food, with which this flame is nourished, as also of the little spiracles or breathing holes, by which it is eventilated; and further, of the Heart it self, whereby it is agitated and driven about here and there; the accension of blood varies also in every one, by means of several other accidents, to wit, as its flame is sometimes great, clear, and expanded, sometimes small, contracted, or cloudy, sometimes equal and in order, sometimes unequal and often interrupted, yea and it becomes subject to many other mutations; also because the Soul it self having gotten a various nature or disposition, it conceives divers affections and manners, whereof we shall speak hereafter; for as much as it is not a little thing, that the disposition of the whole Soul depends upon the temperament of the bloody mass, and the degree and manner of its accension or inkindling.

It clearly appears, from what hath been said, that Fire and Life do dye or are extinguished alike many ways, to wit, there is an end of either, if the access of nitrous food, or the departure of Effluvia's be hindred, or if the oily or sulphureous aliment, requisite to either, be consumed, too much withdrawn, or perverted from its inflammable disposition; of each whereof it is so clearly apparent, that there needs no farther explication.

Thus far we have shewn, that the Life of the Blood, or that part of the Soul growing therein, is a certain kind of Flame; let us now see by what means it is disposed

to burning, and how near it comes to the similitude of a burning Candle or Lamp.

A common Lamp, whether designed to give heat or light, for the most part is wont to be made after this manner; to wit, the Oyl flowing perpetually to the wick, gives continual food to the flame; wherefore as there is but one fire-place or hearth only of light and heat, the action of either is limited only to one place, and so as often as there is need of more places at once, or divers parts of the same space or body to be illuminated or made warm, we place here and there divers lighted Candles or Lamps. But if an Instrument made with great artifice (such as is truly an animated Body) with one liquor only contained in it; should be made hot throughout the whole, and to be kept always warm, it ought not only to be lightly inkindled in the wick, but in the whole superficies, and derived by fit Tubes or Pipes to all the parts of the Machine, then the burning liquor ought to enjoy, proportionably to all its parts, an access of nitrous Air, and to lay aside Effluvia's and other recrements, and ought also to have a supply of that constant expence: these kind of offices are not to be performed any where up and down, but only in some set places; therefore the burning liquor ought to be carried about through the whole with a perpetual turn, that all its portions might enjoy successively all those priviledges, and at once heat the whole capacity of the containing Machine, to wit, both the inward and outward recesses. Indeed such a Bannian or Bathing Engine, artificially made, might aptly represent the real Divine handy-work of the Circulation of Blood, and what burns in it, the Life-lamp.

But it may be objected, that the Blood seems not to be inflammable of its own nature; further, since there is no flame of this heat or effervency to be beheld with the eyes, it may well be doubted, whether there be such a thing or no. I say first, That the Chymical Analysis of the blood shews very many particles of Sulphur and of Spirit, yea a plentiful stock of inflammable Oyl, which are however mixed with other more thick Elements, in a just proportion, to bridle their too great inkindling; to wit, that this liquor might flame out by little and little, and only through fewer parts, for the constituting of a benign and gentle Lamp of life: wherefore the blood being let out of a Vein upon a burning fire, doth in some measure burn, though it is not like the Spirits of Wine, or Oyl of Turpentine turning all into a flame; besides, the whole mass of blood, as the Oyl of a Lamp, ought not to be fired; yea its burning is instituted for that end, that whilst all the Particles of the Mixture being freed, some sulphureous and spirituous are consumed by burning, others more subtil being sent in Troops, might serve for the necessary uses of the animal Regiment; and also others more thick or crass and nourishing, as it were boiled or roasted, might be dispensed for the cherishing all parts; besides, that all the dead, or worn out, and excrementitious may be sent away by fit or convenient sinks, and others constantly substituted in their places by nourishment.

But in the interim, that the vital Flame, which destinated to so many offices, we suppose to be inkindled in the Blood, (otherwise than the common flame, which is plainly conspicuous) appears not at all, a probable reason thereof may be given; as it is most thin, and burns in the Heart, and its depending Vessels as it were shut up in Receptacles; it doth not clearly flame out, but perhaps remains in the form of smoke, or a vapour, or breath; yea, although the blood should openly flame out, yet it might be so done, that its shining being most thin, may not be perceived by our sight, as in the clear light of the day we cannot behold a glowing red-hot Iron, nor shining sparks, nor false fires, nor rotten wood, nor many other things shining by night; why then may not the vital fire, even thinner than they, quite escape our sight? Although sometimes hot living Creatures use to send forth a certain fire or flame only conspicuous by night: For we have known in some endued with a hot and vaporous blood, when they have put off their inner garments at night going to bed near a fire or Candle, a very thin and shining flame to have shewn it self, which hath possessed the whole inferiour region of the Body. The reason of which affection seems wholly the same, as when the evaporating fume of a Torch just put out is again inflamed by a light inkindling, and manifestly argues that another flame, the root of this extrinick one, lyes hid within the Body. For this very cause it is, that from the Mains of Horses, and the Skins of Cats, or other hot Animals being shaken, little sparks as it were of fire leap out, and often flames, only conspicuous in the dark, arise. Besides, we here take notice in a burning Fever, caused by immoderate drinking of Wine or strong Waters, that the blood, as the flame of it is very much increased,

increased, doth grow excessively hot, and such are wont to emit dry breaths, and sharp Effluvia's of heat, not like those that proceed from fermenting or boiling Liquor, but only inflamed. That which some in Feavers have imagined to have seen or observed even burning fires and flame in the eyes, argues indeed that the flame of the blood is very strong, and also that it penetrates the inclosure of the Brain. I knew a certain ingenious Man of a very hot brain, who affirmed, that after a very plentiful drinking of Wine, he was able in the darkest night to read clearly; from hence also may be collected, how the accension of the blood, like that of burning Liquors, is to be increased or made stronger, *viz.* by an agitation of the parts, and a more plentiful affusion of sulphureous food.

But that in the hot blood of living Creatures, the Properties, Affections, and many other accidents of Fire or Flame are found without the manifest form or species of it; what if we should say the cause to be, for that the vital flame of the blood is subjugated, or made subordinate to another form, *viz.* to the corporeal Soul? Wherefore, although it retains the chief qualities and affections of common flame, yet it loses the species of flame or fire; for in every natural mixture, the superiour form exercises a Right and Dominion over all included Particles whatsoever, however fierce and untameable they may be in themselves, and stripping them of their species, ordains and disposes them to peculiar actions in that proper Concrete: when the form of fire excels, that bright burning, that it might propagate largely its ends, destroys and consumes all inflammable objects. But if the form of the corporeal Soul be induced upon the fire, kindled within the blood, it burns forth without fulgor or shining, or destruction of the subject, and is invisible, and as it were subjugated flame, is ordained for the sustaining of life and its offices: but truly the Divine Providence, from the very Creation of the World, hath seemed to have predestinated Forms to natural Bodies, to wit, that they might remain as so many Figures or Types, according to which every portion of matter framing the Concrete, whether animate or inanimate, might be modified; so that the Mass, according to the virtues of the hidden Seeds, being disposed after this or that manner, happens to have the form of a Stone, a Plant, or Brute, or of any other kind; then the acts and affections, appropriate to such a Species, follow the form it self. When therefore Life or Soul is destinated to these kind of Functions of the more perfect Animals, for the performing of which, the blood, after the manner of burning Liquors, ought to be perpetually hot, and as it were inkindled; what should hinder, but that the act of Life, or of that corporeal Soul (consisting in the motion and agglomeration or heaping together of most subtil and agil Particles) may be called a certain Burning or perpetual Fire of the bloody Mass? Wherein although the accidents and chief qualities of common fire are implanted, yet the form of fire is obscured, as being subjugated to a more noble form, *viz.* of the corporeal Soul: not much unlike water, which being congealed into Ice or Snow, lays aside the species of water for a time, and may be applied to other uses far distant from fluidity.

But truly, though we affirm, that the corporeal Soul doth stick in the Blood, yet we do not, that it is adequated or limited to it: because whilst the more thick portion of it, as the Roots of some Tree, fixed in the Earth, are sowed in the bloody Mass, the more noble part of the same Soul, as the higher branches, are expanded in the Brain and nervous System; or as we before hinted, when the vital or flamy part of the Soul is contained in the blood, the animal or lucid portion of it is contained in the Head and its Appendix; by which just limit the Sphere of either may be defined, neither may the vital flame impetuously break through the animal Region, the substance of the Brain being more cold, and also shining or bright, is opposed to it, as it were an icy or glassie Bar, whose interiour frame or substance, the small and slender as it were rivers of the blood, for the sake of cherishing heat, can enter: but truly spirituous Particles plentifully flow from its juyce or liquor, every where heaped up near the confines of the Brain, and there disposed as it were to be stilled forth, which being immersed in the Brain, and more exalted, affords matter, out of which the animal Spirits are procreated, to be derived through the Nerves into the various Regions of the Body.

The second Medical and Phyfical

DISCOURSE.

Of Musculary Motion.

AS there are two chief or primary Faculties of the Corporeal Soul, to wit, the Sensitive and Motive, we have assigned certain exterior Powers of either of them, which are chiefly acted in the Nervous stock, and others interior, the Exercises of which lye within the Brain, to wit, such as the Imagination, Memory, Appetite, &c. What we have publickly discoursed of some time since both concerning internal and external Senses, may perhaps hereafter be brought to light and made publick: in the mean time, because I am opposed, concerning both the natural and convulsive Motion, I think it fit at present to publish what I had meditated touching the Motive power, and what Hypothesis I had conceived of so hard and highly intricate a thing.

The motive Faculty of the bodily Soul is wont to be exercised with another kind of Action than the sensitive, *viz.* with a diverse aspect and tendency of animal Spirits. For that every Sense is a certain passion, wherein the Soul, or some portion of it, being outwardly struck, is forced to nod or shake, and a wavering of the Spirits being inwardly made to look back towards the Head; but on the contrary, every Motion is a certain Action wherein the Soul seems to exert it self whole, or part of it self, and by a declination or fluctuation of Spirits being made to bring forth a Syftasis, and to extend something as it were its member. Further, whilst the Soul so exerts it self, or some part of it self, that the works then designed might be performed, an heap of animal Spirits being every where disposed in the motive parts, sometimes one, sometimes more are raised up by the Soul, which by that means being expanded with a certain force, and as it were exploded, they blow up the containing bodies, and so the same being increased as to their thickness, and made short as to their length, are made to attract the adjoining member, and stir up local motion.

1. In every motion, these three things ought to be considered: *viz.* First, the original of the Action, or the first designation of the Motion to be performed, which is always in the Brain or Cerebel. Secondly, its instinct or transmission of the thing begun to the motive parts, which is performed by the commerce of the Spirits lying within the Nerves. Thirdly, the motive force it self, or exertion of the Spirits implanted in the moving parts, either into a contractive or elastick force. From this threefold Fountain, *viz.* as the business is performed in every one of these in a various manner, very many kinds and differences of Motions are deduced.

1. As to the original or beginning of Motion, we shall take notice, that that which proceeds from the Brain, with a knowing and auspicious appetite, may be called Spontaneous or Voluntary; but that which is wont to be excited from the Cerebel, where the Law of Nature presides, such as are Respiration, the Pulse, with many others, may be called merely Natural, or Involuntary: either of these is either direct, which is stirred up of it self, or primarily from this or that beginning, as often as the appetite requires this or that thing, out of a certain proper, and as I may say, intestine deliberation, and chuses out respective motions; so in like manner, when the ordinary offices of the natural and vital Function are performed, according to the solemn Rite of Nature; or the motion of either kind is reflected, to wit, which depending on a previous sense more immediately, as an evident cause or occasion, is presently retorted; so a gentle titillation of the Skin causes a rubbing of it, and the more intense heats of the Præcordia stir up the Pulse and Respiration.

2. As to the Vehicle of the Instinct, which we suppose to be wholly done by the Nerves, for as much as it is performed by a single Nerve, or by more at once, it is called either a Simple or Complicate Motion; then for that some Nerves help motion more or less than others by sooner or later moving, this or that member is said to be moved first, or by it self, and another by consent: yea, and that consent is wont

wont to be acted or done with neighbouring or more remote parts, and that with a diverse respect: But we have in another place largely shewn instances of these kind of sympathetick motions, as also the causes of each of them, and their manner of being made.

3. There is another, and that a remarkable distinction of Motions, taken from the various constitution of the moving parts: to wit, parts endued with nervous Fibres, and in which the motive Spirits dwell; either they are Muscles, which perform local motions; or membranaceous bodies, the motions of which are terminated in themselves, which therefore we call Intestine. As to what belongs to local motion, of which only we treat at present, although it be confessed by all, that the Brain or Cerebel, and the Nerves and Muscles together one or more, as it were with joynt forces, do contribute to this motion; also, though it may be sufficiently understood, that the beginning of the motion to be performed is designed in the Brain or Cerebel, and that its instinct is conveyed wholly by the Nerves; yet by what means the Muscles perform that work, far exceeding any mechanick virtue or operation, seems most hard to be made plain.

That local Motion is performed by traction, and doth depend upon the contraction of a Muscle, is not only a vulgar Opinion, but is also plain by ocular demonstration; yet it is very much disputed and variously controverted among Authors concerning the manner of Contraction and efficient Cause; some think it enough to say, that the Soul it self, by its presence, doth actuate the Muscle, or contract or draw out here and there its Fibres, as it were a net spread forth. But indeed this is to attribute to the sensitive Soul a supernatural, and as it were Divine virtue. To wit, that the same, by its mere Spirit, was able to bend and force heavy and very great bodies whither it pleases. Further, for what end are the motive Organs framed with wonderful artifice and manifold difference, unless that after the manner of Machines; they might perform their operations by an orderly structure, and as it were mechanical provision of parts? Truly it will be no hard thing to apply the exercises of a Muscle and of the whole nervous Function, and to explicate them according to the Rules, Canons, and Laws of a Mechanick. Before I enter upon this, I think it not amiss first to speak something of the make, conformation, and use of a Muscle in general. The ancient Anatomists, almost all with one consent, did divide the body of a Muscle into Head, Belly, and Tail; taking for the Head the extremity of the Muscle connexed to the part, to which contraction is made; for the Tail, the end or portion of the Muscle inserted to the part to be moved; for the Belly, the part of the Muscle coming between, which is beheld more tumid, with a bulk of flesh; then for the performing of motion, they did suppose the Muscle to swell up about the Head and Belly, and so to grow short as to its length, and to attract nearer to it self the hanging part; yet by what means, and for what cause the belly of the Muscle swells up, none yet hath clearly unfolded.

Moreover, although the Doctrine of the Nerves hath been much described by the most skilful Anatomists of every Age, so that the Muscles of the whole Body (as it is thought) have been exactly recounted, and offices assigned them, and monstrous names fitted for the expressing them, yet the true frame of a Muscle, not yet shewed by others, first began to be delivered lately by the most ingenious Doctor *Steno*. He hath found out in every Muscle two opposite Tendons, into which both the Fibres go; yea, and hath taught, that the same Fibres wholly, which compose strictly on one side, the Tendon of the knitting being more loosely joyned, do constitute the flesh; yet so, that some being laid upon others, compose the thickness or profundity of the Muscle, and some laid nigh to others, its breadth or latitude: he calls the former Fibres *Ordines* or Orders, but the other *Versus* or Turnings; then the parts and composition of a Muscle being after this manner laid open, he aptly reduces its Figure to Mathematical Rules, and according to Canons thence taken, shews the action to be unfolded: because he advertising, that in a Muscle with a simple right line, all the fleshy Fibres, parallel within themselves, and for the most part equal, are carried from one Tendon obliquely into another; and that those Tendons are sowed in the opposite ends or angles of the flesh, whereby he most ingeniously describes a Muscle to be, *a Collection of moving Fibres, so framed together, that the middle flesh constitute an oblique angular Parallelopipedum, but the opposite Tendons compose two quadrangular Prisms or Figures*. The Instrument which Painters use for the describing many Examples of the same thing, fitly represents the figure of this delineated in a plain: because
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the styles being fixed to the opposite Angles, express the insertions of the Tendons and the Parallelogram it self the fleshy part of the Muscle: for when the opposite Angles are diduced to a great distance from one another, and made sharper, the two sides come nearer together, and render the *Area* or middle of the Figure longer, but narrower, a Muscle not contracted is denoted: But if the same Angles are brought nearer, and made more obtuse, the two sides go farther apart, and so make the middle of the Muscle shorter, but also wider, a contracted Muscle seems to be represented. In the mean time, in either site of the aforesaid Parallelogram the quantity or longitude of the sides is not changed, but only their position, and the largeness of the Angles is varied: whether it may be also so in a Muscle, shall hereafter appear. In the mean time we shall take notice, out of the observation of the same most Learned *Steno*, that a Muscle is either simple, which consists of one belly and two Tendons, of which sort there are many in the Arm and Leg, which are the movers of the fingers and toes, yea and almost every where in other parts of the Body; or compounded, that hath many bellies, to every one of which, two opposite Tendons are hung; yet so, as when those compounded Tendons, to wit, two together, shall be joyned, one compound Tendon enters the middle of the flesh, and the other embraces the middle on both parts. This is evidently discerned in the Masseter or Throat-muscle, the Deltoid, and divers others, in all which, even as in a simple Muscle, whilst the fleshy Fibres (to which only the motive power belongs) are contracted, the opposite Angles are enlarged according to the insertions of the Tendons, and so the bellies being made shorter, and at the same time thicker, do swell up.

In a simple Muscle, according as one Tendon or both together, or either by turns, ought to be drawn; besides, according as the part to be drawn is thin, or broad, or planted near or far off, and for several other respects the fleshy belly is diversly formed; and as the Rhomboides is its chiefest regular figure, yet that also is sometimes triangular, sometimes trapezial or quadrangular, pyramidal, spiral, semilunar or like an Half-moon, or of some other irregular form. But in all these kind of Muscles, the fleshy Fibres, according to all their positions, whilst they are contracted, at the same time intumesc or swell up, and are shortned from either end towards the middle, though in all Muscles not always in a like manner and dimension; for if either Tendon be to be drawn at once, the contraction from either fleshy end, is for the most part equal; but at the same time, if one only be drawn from the others that are immoveable, the contraction is made less, and sometimes, *viz.* where the flesh immediately sticks to the bone without any notable Tendon, almost none.

The compounded Muscles are distinguished with a far greater variety; for besides their diversity of figures, all which would be an immense labour to enumerate, according as they are more or less compounded, or have their bellies more or fewer, with a manifold Series stretched out here and there, with Fibres sometimes of the same, sometimes of a divers order, they are very much differenced.

The more thin and less compounded Muscle, when perhaps it is sorted into two or three bellies, disposed in the same being plain, hath the series of fleshy Fibres for the most part looking diversly, all the exterior Tendons embracing one end of the Muscle, and hath the others intermediate or that come between immersed about the other end; so that the several fleshy Fibres of every Belly lye parallel between the one extreme Tendon and the other intermediate Tendon. The thicker and more compounded Muscle, that it might perform at once quick, hard, and long motions, hath many bellies planted in divers plains, and the series of fleshy Fibres (which are all short) looking many ways. The frame of them, although it be very intricate, that one can scarce number all the bellies, much less observe their habitudes, mutual dependences, and means of connexions among themselves; yet they may in some sort be reduced to this common Rule in most, to wit, in the great compounded Muscles, such as are those round ones which contribute mighty strength and elastick force to the middle of the Arms and Legs, we may take notice, in one end of two vast exterior Tendons covering almost the whole superficies of the Muscle, which being divided presently into many fissures or clefts, are stretched out between a broad shoot or claw to the other extremity of the Muscle; then on the opposite side, about this other end, a great Tendon enters the middle of the flesh, which also is cleft or divided presently into many laps, distributed through the whole interior belly of the Muscle. And as these interior lamens or laps meeting with the exterior, and being stretched out almost to the opposite end, look many ways, and have their superficies turning
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on every side, some every where are destined to others opposite, and are committed or sent through the intervenient series of the fleshy Fibres: such a Muscle, whose very many bellies being planted in divers plains, do look many ways, can by no manner or way be cleft or pulled asunder, but that the other series of fleshy Fibres must be broke asunder in the midst. The bellies of a Muscle, so very much compounded, although manifold, yet are very slender, so that the fleshy Fibres thereof being most short, and having their Angles always equal, but oblique, with the tendinous laps, for that cause make a most strong attraction. Because the numerous series of fleshy Fibres seem as it were so many distinct posts or supporters set together for the moving of any weight, or rather, for that either great Tendon is presently so cut into many lappets, it is like, as if a mighty draw-rope, hung for the drawing up a body, should be presently divided into many little ropes or cords, by which many men might draw at once. For whilst the several series of the fleshy Fibres are shortned at once, they draw the opposite Angles of all the tendinous lappets together, and so the belly of the whole Muscle being intumified or swelled up, they strongly draw either end, or that which is moveable towards the middle.

On every Muscle, both simple and compound, there is stretched on every side a membranaceous covering; besides, other little Fibres transverse, to wit, membranaceous, are woven between the direct moving fleshy Fibres of every one, which clothe each of them, and keep or fasten them together, yea (as it seems probable) they both communicate to all the fleshy Fibres the same instinct of obeying the motion, and also carry to the Tendons, the troops of the inflowing Spirits, received from the Nerve.

The Arteries and Veins, inserted in the middle of every Muscle, send forth little branches on all sides, obliquely cutting the moving Fibres, from which lesser branches dispersed between the *Interstitia* of the flesh, water them all with a flux or reflux of the blood. But the Nerve entring the fleshy belly of every one, distributes some smaller circles only in the neighbouring parts, as it were bearing only the Symbol or mark of the commanded action, commands the execution of it to the Guard or inferiour Company of the fleshy Fibres and membranaceous Fibrils.

I had designed Figures, almost of every kind of Muscles, to be engraved according to the natural appearances: but the Printer making haste, I had not the opportunity to dissect an humane Body, having only taken some few Muscles from the Leg of an Ox, we have caused them to be delineated to the life, which are to be seen at the end, although the famous *Steno* hath already accurately performed this task. Which Figures, if any one think too much bending to Mathematical Rules, he may with an easie labour behold the same Conformation of a Muscle, as he hath described it in the flesh it self. For if a simple regular Muscle be cut out of any Animal, and so placed, that the Tendons here and there be held on the sides, the fleshy Fibres between them intercepted in oblique and equal Angles, be pressed upon an Horizontal plain, the flesh will be exactly like a Rhomboides or an oblique angular Parallelopipedum. Then if the site of the same Muscle being changed, and its Tendons placed above and below, you shall cut long-ways the inferiour Tendon, and pull the parts one from another, and divide by tearing the whole Muscle into two parts, you shall presently see a most elegant spectacle, all the fleshy Fibres disposed in one series, yea and parallel between themselves, and of the same longitude, to proceed from one Tendon into another, and to make both Angles always oblique and equal; although we cannot cleave after this manner the compounded Muscles, whose manifold bellies have a diverse plain, yet it will easily appear, to one curiously cutting them, either raw or boiled, two Tendons to be fitted to each Parallelogram of the flesh.

As to what respects the action of a Muscle, we plainly saw in dissected living Creatures, (which only shew this) that it is contracted, yet not so as the old Opinion declared, to wit, that the Fibres being contracted from the end towards the beginning, one extremity of the Muscle was carried towards the other; but the fleshy Fibres only and their ends are seen to be contracted towards the middle, the Tendons being still unchanged and altered neither as to their longitude or thickness: which thing also the most Learned *Steno* did first of all observe long since. This is clearly perceived in the Diaphragma and the Muscles dedicated for Respiration, which are moved with a constant change: for as often as the Muscle is contracted, you may behold all the fleshy Fibres, in either extremity, to be pulled together at once, and as if they would enter on either side one another to be carried nearer, and so at once to become

become shorter and thicker, then from that constriction to return loose to their wonted longitude and slenderness. Whilst you behold this to be so done, you will easily think, that something, to wit, spirit or subtil matter doth flow from the Tendons into the flesh or fleshy Fibres, which entring them on either side, blows them up, and at the same time draws them together nearer within themselves, that presently all the Fibres are made shorter and intumified; then when that matter recedes from the flesh or fleshy Fibres into the Tendons, the Fibres being emptied and loosned from their corrugation or wrinkling, are restored to their former longitude, and so by turns: whether this in truth be so done or no, shall be discoursed anon.

In the mean time, that we may proceed to other appearances of Musculary Motion, if that the Membrane of the Muscle being drawn away, you shall separate some fleshy Fibres from others by cutting the little fibrils, whereby they are joyned, and loosen them quite, you will see them so singular and free, to be wrinkled or drawn together in every motion like the others compacted together.

Further, I advertise you, that these Fibres so loosned and freed, some cut off in one end, and separated from the Tendon, did yet contract themselves to the motion of the Muscle, together with the other Fibres, about the other whole end, without that cut off in the mean time growing flaggy or loose. After this I divided with a pair of Scissers, a certain fleshy portion of the thinner Muscle, in three or four pieces transverse, the bigness of an inch: which being done, the portions cut off in either end, only entred into, for a short space, some light and inordinate corrugations, and presently became immoveable. The other extreme portions of the Muscle so cut, sticking to the Tendons, continued to be much more lively and longer contracted, but irregularly and convulsively, to wit, with a certain intortion of the Fibres. Truly, in the Fibres so cut off, some small footsteps of contraction did remain for a little while, partly by reason of the Instinct of Motion delivered through the membranaceous fibrils, by which they did yet cohere with the whole flesh, and partly because the animal Spirits, implanted in the fleshy Fibres, now divided from the rest, and left without influence, did exert or put forth their utmost contractive endeavours after the usual manner. For this reason sometimes in the Heart taken out, and in a piece of it cut off with a Sword, as also in other Muscles, after the Nerves and sanguiferous Vessels are cut off, a contraction and relaxation continue for some time. The other Fibres cut off only by reason of the access and recess of the Spirits from the Tendons, were able still in some measure to be contracted and relaxed.

When in the Diaphragma I had freed many singular Fibres from the knittings of others, I tryed what Ligatures put in several places of them might effect. Some of them then being bound about the middle, were contracted even as the whole fibres, but with some little swelling about the Ligature. When I had bound others about the ends, where they cohere to the Tendons, now one, then another, the motion was chiefly and almost only continued about the free end. Further, in the fibres bound at both ends at once, the contraction wholly ceased.

Contraction and Relaxation are not only seen, and indeed probable, in the Heart, but in the Diaphragma and other Muscles appointed for Respiration, which use to be performed in all, acting vicissively, according to the Instincts of Nature, and for the most part equally (though there are not the like intervals of motions in all) yea, and the Muscles serving to the voluntary function, enter oftentimes into spontaneous Contractions, unless they be hindred by their Antagonists, as it appears, for that the Spasm or Cramp of one Muscle comes upon the Palsie of another. Contraction and Relaxation are iterated more swiftly in the Heart, than in the Muscles of Respiration, and so perhaps in these, than in several others. In those ready to dye, the fleshy Pannicle every where trembling, clearly shews their changes by innumerable beatings or leapings.

As to what respects the Humors, whereby all the fibres of a Muscle, viz. the fleshy, tendinous, and membranaceous, and what lies between them, seem to be watered, filled, or blown up, we ought to take notice of them, at least two of them, (to wit, the bloody and nervous liquor) if not more. And in the first place it is clearly manifest to the sense, that the blood doth wash all the fleshy and membranaceous fibres which are interwoven with these: because, if the Spirit of Wine, tintured with Ink, be put into an Artery belonging to any Muscle, the Vein in the mean time being tyed close, the superficies of all the fleshy fibres and transverse fibrils are dyed with blackness, the Tendons being then scarcely at all changed in their colour; it appears from hence,

hence, that the blood doth every where outwardly water all the flesh or fleshy fibres, and only those. We have not yet found by any certain mark, whether the blood enters more deeply the fleshy fibres, or instils into them the subtil liquor falling from them, although this last seems most probable; but indeed we affirm, that all the fibres, *viz.* the fleshy, tendinous, and membranaceous, are perpetually and plentifully actuated by the implanted and inflowing animal Spirits, and constantly imbued with the nervous liquor, which is the Vehicle of the Spirits. But how far, or how much the aforesaid humors conduce to the exercise of the animal Faculties, doth not easily appear; but because the animal Spirits cannot consist without the nervous liquor, and depend very much upon its disposition, we may conclude, that it doth serve something to the actuating the motive power; for that reason also, that the continual afflux of the blood is nevertheless necessary, an Experiment cited by the Ingenious *Steno*, and proved of late by others, plainly confirms. He hath observed, that in a living Dog, the descending great Artery being tyed without any previous cutting off, the voluntary motion of all the posterior parts have ceased, as often as he tyed the string, and as often returned again as he loosned the knot.

These are the chief Phænomena to be observed concerning the frame and action of a Muscle in the dissection of Animals, both of such as were living, as also of the dead and dying. From which, however placed together and compared among themselves, how difficult a thing it is to constitute the *Ætiology* of the animal motive faculty, appears even from hence, that the most Ingenious *Steno*, after he had very accurately delivered the Elements of his Myology, by himself first invented, nevertheless he wholly avoided that Hypothesis which might be founded out of them; for that he yet doubted, whether the explication of a Muscle by a Rectangle were convenient to Nature in all; wherefore when many run to the manner of musculary Contraction, by the repletion of the fibres, and others from their inanition, and some to both, he ingenuously professes, that the true causes of this thing do not clearly appear to him.

And as to this abstruse matter, although I do not believe that I am able to bring to light, or shew any thing more certainly than others; yet as in mechanical things, when any one would observe the motions of a Clock or Engine, he takes the Machine it self to pieces to consider the singular artifice, and doth not doubt but he will learn the causes and properties of the Phænomenon, if not all, at least the chief: In like manner, when it is brought before your eyes to behold and consider the structure and parts of a Muscle, the conformations of the moving fibres, their gestures and alterations whilst they are in motion, why is it that we should despair to extricate the means or reasons of the motive function, either by truths or by what is next to truth? Wherefore I think it may be lawful for me here to bring before you our conceptions and notions concerning this thing, indeed not rashly taken, or to comply with our former Hypothesis, or to oppose any other; which if they shall not satisfy all, may at least excite others to find out better.

But we shall here repeat what we have mentioned before, *viz.* that the power or virtue by which a Muscle is moved, proceeds from the Brain, is conveyed through the Nerves, and is performed by the fleshy fibres contracted, and by that means abbreviated. This latter is proved by ocular demonstration, yea it appears by it, that the motive force doth depend also upon those former, and is so transferred by a long passage, that the influence of the Spirits being suppressed in their beginning, or intercepted in the way, for that reason the exercise of the designed motion may be hindered. Further we notify, that the motive force is far greater in the Muscle, or in the end, than in the beginning or middle: because the Brain and depending Nerves are made of a tender and fragil substance, and can pull or draw nothing strongly; but the Muscle putting forth strongly its contractive force, seems almost to be equal to the strength of a Post or Crow, or of a Pully or Windlace. Sometimes the local motion is a compound Action to be performed of many Organs, which consist in divers places, and as its virtue is far more strong in the end than in the beginning or way, we will inquire by what means, as it were mechanical, the motive force may be so augmented or multiplied in its progress, then what is brought to the motion from the several Organs.

As to the first, in Artificial things, when for the facilitating of motion, and the increasing the moving force, many Instruments are invented, all of them, or at least the chief, may be reduced to these two Heads, *viz.* first, either the same force or impression may be continued, without the addition of any new force, from one term

or end to the other, or from the first mover to the thing moved, which notwithstanding may be much increased in the way, as the Centers of Gravity are farther off or multiplied; for the farther the motion is begun from the first Center of Gravity, the stronger it proceeds, as is beheld in a Crow or Leaver, and in other things reducible to a Leaver. Then if other things be disposed beyond the first Center of Gravity successively before the end of the motion, as in a circular Wheel, the same motive force is wont to be increased very much. But to this there is required, that the instruments of motion be sufficiently strong and tenacious in their whole tract; for otherwise the motive force being increased, the same breaking falls down before the designed action be performed. Secondly, there is another way of multiplying the motive force to a great degree, and also at a great distance, which is performed with the addition of new forces or of fresh supplies, to wit, when the elastick Particles, or those making the force, being disposed and shut up in private places, as it were little Cells, afterwards, as occasion serves, are sent forth by a light contact or blast of a remote Agent, into the liberty of motion, which they readily perform. By this means, Air compacted and shut up, when it is permitted to get out, impetuously forcing a Bullet or other object, sends or drives it out a great way. It is sufficiently known what mighty and often horrid forces Gun-powder yields about the end of the Explosion, when in the beginning or first inkindling, the force being transmitted through the fiery fume, as yet weak, might be restrained by a light impression of the hand. There are also other explosive little bodies of a various kind, which being hid in convenient Boxes or Cells, when they are raised up into motion by an inkindling, or irritament, or provocative, do often exert an incredible force. It behoves us then to inquire from which of these ways it comes to pass, that the motive force doth in the Muscles so far exceed the force transmitted from the Brain through the Nerves, or whether the action of the Muscular Motion be merely contractive, or rather elastick, or in some measure explosive?

Concerning these things it manifestly appears, that the Muscles do draw, to wit, being abbreviated, do bring the Tendon with the hanging part towards it self. Further, for as much as there is need for the offices of traction to be sometimes more strongly, sometimes more weakly performed by them, so to have the Centers of Gravity now nigher, now farther off planted from the beginning of the motion; hence the Muscles which extend or bend the Thigh, especially the *Psoæ* and *Glutæi* (great Muscles beginning in the Breast, and reaching into the Thigh) do hide their fleshy moving fibres deeply within the Trunk of the Body: but those which turn about the Thigh are constituted either near the hole or the rising of the Bone of the Thigh, or somewhere thereabout; in like manner it is observed in all the rest of the members, that the belly of the Muscle gets a more remote or nearer site from the article or hinge of motion, as it designed for performing either a stronger or weaker motion: But truly this doth not hold as to the other moving parts, to wit, the Brain and Nerves, which cooperate with the Muscles in the motive Act; because, although the motive force is carried by a long passage through all these Organs, yet it seems impossible, that a contraction so strongly performed by a Muscle, should be begun by the tender and immoveable Brain, and continued through the small and fragil Nerves, but that it must necessarily be supposed some motive Particles are hid in the Muscle, which, as occasion is given, are stirred up according to the Instinct, delivered by the Nerves from the Brain, into motion, as it were with a certain explosion. But what these Particles may be, by what means they are instigated into motion, and how they induce the contraction of a Muscle, seems most difficult to be unfolded.

Truly it may be lawfully concluded from the effect, that elastick Particles, and fit to move themselves, are contained in the Muscles, and hid every where within the fibres, because the Anatomy of living Creatures discovers often a motion in a separated Muscle, yea in its fibres divided one from another. The Hearts of some Animals beat a long while being pulled out of the Body, the Muscles cut off, sometimes perform the motions of contraction. In great labouring Beasts slain or dying, although the Heart and the Brain be taken out, the fleshy Pannicle performs for some time very many turns of contractions and relaxations. From these it is manifestly clear, that there are among the Particles of the Muscles some agil and self forcers, or carried by their own force heaped together, which, although the animal œconomy be very much disturbed or overthrown, do enter into motion of their own accord, yet in a tranquil estate they perform no actions, unless commanded by the Brain or Cerebel, and delivered by the Nerves.

Whilst

Whilst a Muscle is contracted, the cutting up of a live Creature shews only the fleshy fibres to run into motion by themselves, to wit, being made more tumid; sharper, and shorter at the same time, to amplify or enlarge the belly of the Muscle; and in the interim, the Tendons, as if immoveable of themselves, to wit, not altered either as to their thickness or length, only pulled as it were by the fleshy fibres, to be moved, and to draw with them the moved part; whence it seems to be manifest, that the animal Spirits or elastick Particles, whichsoever they are, whilst they perform the Musculary Motion, are only or chiefly agitated among the fleshy fibres. Further, hence any one may strongly think, that such Particles are not at all contained, or are wholly idle in the tendinous fibres; for as we have noted, that the Tendon is not changed in the act, we may lawfully suspect, that it is only instead of a Crook, by which means the fleshy fibres being contracted, may draw the member to be moved at a distance from them towards themselves.

But indeed it sufficiently appears by evident signs, that the animal Spirits or elastick Particles do lodge within the tendinous fibres, and truly much more plentifully than in the fleshy: First, the sense shews this, to wit, the touch, which is much sharper and far more sensible in the Tendon than in the flesh: yea any irritation or breach of the unity happening in that part, brings not only a most troublesom sense, to wit, a very cruel pain, but besides, is wont to excite in the neighbouring flesh a Tumor or Swelling, and frequently most grievous Convulsions; whence we necessarily conclude, that the animal Spirits do inhabit the tendinous fibres in great abundance: but what they do there, and by what means they serve to the motive function, we will next inquire.

As often as the motion of a living Muscle was beheld by me, I considered and weighed in my mind by what means all the fleshy fibres were contracted and released by turns, I could conceive or collect no other thing than that in every contraction, the Spirits or certain elastick Particles did rush into the fleshy fibres from either Tendon, and did intumesc and force them nearer towards themselves or together; then the same Particles presently coming back from the flesh into the Tendons, the relaxation of the Muscles happened. In a bare or naked Muscle, when I had separated every fleshy fibre or a company of them apart from the rest in the whole passage by help of a Microscope, I most plainly perceived the Tumor, begun at either end of the flesh, to be carried towards the middle, as it were by the Spirits, entred here and there at once. Further (which I mentioned before) each fibre being tyed about the middle, being as it were as yet free and compacted with the others, was contracted or drawn together; but a Ligature being put to both ends, it remained flaggy constantly above or beyond the bound place. But that I might no longer doubt concerning this, I applied two Ligatures, at equal distances from the middle and the ends, about the same bundle of fleshy fibres, which being done, a contraction and swelling up arising presently from either fleshy extreme to the places bound, went no farther; the middle part between in the mean time being unmoved, remained flaccid; whence it may be well concluded, that in every musculary contraction the animal Spirits or elastick Particles do leap out from the tendinous fibres into the fleshy, and vicissively in the relaxation, recede or run back from these into those.

However this being proved and granted, there yet remain very many difficulties concerning Musculary Motion; for first, it may be asked how the animal Spirits, which enter silently, or without any incitation, or Tumor, the tendinous fibres do so blow up the fleshy fibres, that they are able to force them altogether into shorter spaces.

For the producing this effect, plenty of Spirits leaping from the tendinous fibres, do not seem alone sufficient; but besides, we may suppose some other kind of Particles, implanted in the fleshy fibres, meeting with the others flowing from the Tendons, do forthwith strive, whence a mutual rarefaction, and turgescency or swelling up of them, or an inflation or sudden blowing up of the containing bodies, together with an abbreviation or shortning of them, doth arise; not much unlike, as when the Corpuscles or little bodies of fire entring into a piece of leather, or any thing, and forcing variously here and there its implanted Particles (whereby they are presently insnared) make it so to be stuffed and wrinkled; in like manner also the animal Spirits, although they pass through the Tendons, where they are solitary or by themselves, without moving them (as the Effluvia's of heat in Metals or more dry bodies) yet being dilated in the flesh, for that there joyning with elastick Particles of another

kind, they are expanded or stretched out, they cause the sudden inflations and corrugations of the containing fibres. But we have elsewhere shewn, that such Particles divers and wholly heterogene to the nature of the Spirits, may be copiously and easily carried to the Muscles. For indeed it is plain by ocular demonstration, that the blood doth every where wash and water outwardly all the fleshy fibres, which besides, it is thought not only to nourish, but also to be busied about the offices of the animal Function: and what can be less suspected, than that it doth instil into their Pipes a certain subtil liquor, whose Particles being agitated, and also rarified by the Spirits flowing therein, stuff up the fibres, (as we but now hinted) and compel them intumefied, by reason of the assault on either side made, into shorter spaces?

But that the fleshy belly of the Muscle, whilst it is contracted, doth swell up, is not at all to be doubted, because this is evidently beheld by the sight and touch in the dissection of living Creatures: to wit, all the fleshy fibres being wrinkled together, are made more tumid and sharper, and so shorten the Muscle, and make it also thicker and broader: For the more certain belief of this, when I had bound some of the fleshy fibres, separated from the knitting of the rest, and had left others near them loose, there appeared a notable difference between those flaccid or not swelled, and these intumefied or swelled up in every contraction of the Muscle.

But if it be demanded, of what nature, to wit, whether spirituous-saline, as may be believed, or of any other disposition, the animal Spirits, derived from the Brain into the Muscles, may be; and then whether the other Latex, immediately carried to them from the blood, is sulphureous or nitrous. Concerning these, because it appears not to the sense, we shall pronounce nothing rashly or positively. But even as in other natural things, the active Particles of a various kind, which being unlike among themselves, are found apt mutually to grow hot, or to be struck off from one another, or otherwise to be rarified or expanded; and as the intestine motions of Bodies, and especially the elastick, such as are the contractions of the Muscles, can only proceed from the congressions of such like, certainly it may be lawful to presume, that these do wholly depend upon such a cause.

Therefore as to the Muscular Motion in general, we shall conclude after this manner, with a sufficiently probable conjecture, *viz.* that the animal Spirits being brought from the Head by the passage of the Nerves to every Muscle, and (as it is very likely) received from the membranaceous fibrils, are carried by their passage into the tendinous fibres, and there they are plentifully laid up as in fit Store-houses; which Spirits, as they are naturally nimble and elastick, where ever they may, and are permitted, expanding themselves, leap into the fleshy fibers; then the force being finished, presently sinking down, they slide back into the Tendons, and so vicissively. But whilst the same animal Spirits, at the instinct given for the performing of motion, do leap out of the tendinous fibers into the fleshy, they meet there with active Particles of another nature, supplied from the blood, and presently they grow mutually hot; so that by the strife and agitation of both, the fleshy fibres, for that they are lax and porous, are stuffed up and driven into wrinklins, from all which being at once wrinkled or shrivell'd up, the contraction of the whole Muscle proceeds; the contraction being finished, the sincere or clear Spirits, which reside or are asswaged, go back for the most part into the tendinous fibres, the other Particles being left within the flesh; the loss or wasting of these the blood supplies, as the Nerves do those. By what instinct the muscular contraction begins and ends, shall be inquired into presently.

That the animal Spirits, flowing from the tendinous Fibres, may enter equally all the fleshy, there are two Tendons in every simple Muscle, which are so constituted, according to opposite Angles, that the Spirits running to them from a twofold starting place or bound, might presently fill the whole belly of the Muscle, and that motion being finished, might immediately swiftly retire. If the contraction ought to be performed indifferently towards the middle of the flesh, the Tendons for the most part are equal; but if the motion inclines more towards one region of the flesh, one Tendon (to wit, which may supply a greater company of Spirits) exceeds the other in magnitude. If the Muscle, whereby it may be the stronger, is big and endowed with an ample bulk or substance, it is divided as it were into many Lobes or Bellies, and two Tendons are ordained to each of them; to wit, to the end that the animal Spirits might be carried through short passages from the Tendons into the fleshy fibres, and might leap back again: because the compounded Muscle doth not always contain more series of moving fibres, that it might perform many and divers motions,

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but that it might make the same motion often with the greater strength. For, as we hinted before, as a simple Muscle was as a single leaver or bar, the compound seems as if it were many leavers or bars serving for the removing the same body conjunctly.

Further, hence we may observe in some Muscles, which are simple and regular, that all the fleshy fibres are equal, and so all the tendinous of one extreme being put together, are equal to all of the other end being put together; yet they single, where they are shorter in one Tendon, are longer in the other, and so disposed, that the tendinous fibres on either part, the top and bottom, have their excesses inverse, and at once equal; to wit, that here a long is laid upon a short, or the longest upon the shortest, and there quite contrary, the shortest upon the longest, to the end, that the motion might be so made every where in this or that side of the Muscle, or at the end more strong, more plentiful Spirits flow together into those parts from the longer tendinous fibres, and on the contrary: wherefore in some Muscles less necessary, where the part of the flesh growing to the bone, either becomes immoveable, or only serves for the filling up of empty spaces, one Tendon is shorter or lesser, and oftentimes degenerates into a bony or cartilaginous hardness. Further it is observed, as to other strong and greatly moving Muscles, that their Tendons are not so disposed, as if they were only stays, props, handles, or hanging crooks of the fleshy fibres; for so they are only constituted in their extreme ends; yet the tendinous fibres, that they may be made more apt promptuaries of the animal Spirits, being stretched out almost into all parts of the Muscle, receive every where both ends of the fleshy; which indeed yet more manifestly appears in the compound Muscles, for that one Tendon being compounded, embraces the extreme flesh, and the other enters into the middle of the flesh, as hath been already shewn.

But truly the animal Spirits, whilst they leap out of the tendinous into the fleshy fibres, are not sufficient of themselves for the wrinkling of them, but require another elastick Copula from the blood; this may be argued from many reasons. First, it seems to appear from this, that the same Spirits being solitary or by themselves, though most thickly planted within the Tendons, stir up no Tumor or Contraction, whilst they are moved in them; wherefore being dilated within the fleshy fibres in a lesser quantity, and having got a larger space, they would be stretched out, unless they met or strove with other Particles, much less would they obtain a contractive force. Besides, when any wound or grievous trouble happens to a Tendon, the belly of the Muscle or fleshy part is chiefly troubled with a Tumor or Spasm; for the Spirits being irritated, not so much within themselves, but where they are violently driven among heterogeneous Particles, stir up the greatest tumults and inordinations. But further, when the fleshy fibres are watered with the sanguineous humor beyond other parts, and more than may suffice for their nourishment, for what other use should it be assigned, unless that it may contribute to the motive function? Especially we take notice in lean Bodies, which are more sparingly nourished, that the Muscles being fused or drenched with more plentiful blood, do perform the strongest endeavours of motions: moreover, it doth not appear by what way besides, the expence of the Spirits in a Muscle, consumed with continual hard motions or labours, should be made up or renewed, unless, besides the small supplements by the Nerves, others sufficiently plentiful should be supplied from the bloody mass. Add to these, that members destitute of the wonted afflux of blood, easily fall into weakness or a Palsie; and that from the observation of Doctor Steno, in a live Dog the trunk of the descending Artery being tyed, all the lower or posterior members were suddenly deprived of motion. And though it doth not yet appear plainly to me, whether the exclusion of the blood from the spinal Marrow, or from the Muscles themselves, or from both together, be the cause; yet however it comes almost to the same thing, for as much as the animal Spirits being procreated within the Head, and stretched out by the medullary and nervous Appendices into every member, without the concurrence of the blood, they should not be able to perform the loco-motive power.

Having thus far explained by what means a Muscle being contracted in the fleshy part, as to all the fibres at once, performs the motive function; we shall next inquire, what is the reason of the Instinct whereby every motion, both regular and irregular, is wont to be obeyed or is performed. Concerning this in general, it first appears, that the motions of every regular motion, yea and the impulses of some irregular motions being conceived within the Brain or Cerebel, are transmitted from thence by
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the Nerves to every Muscle. This (as we have elsewhere shewn) is most evidently declared by the effects and consequences: yet here great difficulties remain, to wit, how by the same passages fresh forces of animal Spirits are conveyed from the Head to every Muscle, and at the same time the old ones exercising the Empire of the Soul; besides, with what difference and divers carriage of the inflowing Spirits, the Nerves perform either of these tasks, or both these offices.

Of these, as I conjecture, it seems that the animal Spirits, which flowing continually from the Head to refresh the forces of the implanted Spirits, are carried to the Muscle by the Nerves, do move to it quietly and easily, and being there presently received by the membranaceous Fibres, they go apart into the Tendons: which kind of relief, although it should be but little in bulk, yet because it is carried night and day by a constant course, it easily arises to a sufficient provision for the continual filling up of the Tendons. But that we suppose, the Spirits so brought perpetually to the Muscle to be transferred by the membranaceous Fibres, and not by the fleshy, to the Tendons, the reason is, because if they should first enter into these, straight running into an elastick Copula, they would stir up the Muscle into continual motions: more over, for that in the Heart and Muscles of Respiration the fleshy Fibres are exercised with a perpetual motion, they wait not for the passage of fresh Spirits to the Tendons.

But as to what respects the Instincts delivered through the Nerves from the Head for the performing, or staying, or any ways altering of the muscular motion, of these we ought first to consider, that the moving animal Spirits, whose companies or throngs constitute the Hypostasis of the bodily Soul, have these two properties as it were implanted in their nature; to wit, that whilst they are lively, numerous, and free, they exert or expand themselves, then that force being finished, they being a little diminished, retire themselves and grow quiet; but afterwards being refreshed, they leap out again, and so vicissively. Waking and sleep, and the alterations of work and idleness or rest, inbred in all living Creatures, sufficiently declare this. Wherefore to the impulse or instincts of some Muscles, (which are wont to be perpetually contracted and released) scarce any thing more is required, but that their Tendons may be supplied by the Nerves with a constant influx of animal Spirits; but the Spirits themselves, because they are numerous and expeditious of their own nature, do willingly leap out into the moving Fibres, then the charge being performed, after a small loss or expence, they immediately withdraw, and being again presently recruited, they are again expanded, and so vicissively. Further, their actions (which chiefly are Pulse and Breathing) are variously changed according to the degrees of heat or of the affections, for as much as the Spirits being brought by the Nerves, are sent from the Cerebel, sometimes more remissly, sometimes more plentifully, or more nimbly.

Further, in some other Muscles subject to the Empire of the Appetite, as the animal Spirits naturally affect turns of expansion and recess, there is only need of a sign to be given, either for the performing or stopping of the commanded motion; either of which, the inflowing Spirits by their various knocking against the Muscle, easily perform, in ordering the implanted Spirits into various aspects or tendencies. When the Muscle is contracted, the implanted Spirits, whilst they are loosened from either end towards the middle, look and tend with a changed front from the middle towards either end. And so, whilst the inflowing Spirits carry the Symbol of performing Contraction, they being incited by heaps within the Nerve, more fully blow up its end, inserted to the Muscle, (where they are more thickly crowded together) and so cause it there to be contracted and abbreviated; whereby it comes to pass, that the same inflowing Spirits, about to enter into the Muscle, are at that time stopped by a mere heap, or rather are called back towards the intumefied Nerve; wherefore by and by the whole series of the implanted Spirits (hence their inclination being changed) also looks that way, and so the inhabitants of the Tendons, leaping out from their little Cells into the fleshy Fibres, cause motive contraction: then the motion is broken off or ceases as soon as the Spirits being before called back towards the Nerve, do tend again into the Muscle, and so the front of the Army being again changed, bands of the implanted Spirits are presently compelled into the Tendons. That the thing is in a manner thus, I am perswaded, not out of a mere agreeableness or concinnity of our Hypothesis, but from Anatomical observation. Because once dissecting a Whelp alive, when by chance I beheld some Muscles of the hinder part of the

Head

Head and Neck divided and separated at the same instant, wherein the fleshy Fibres, as also the Nerves inserted into them, were seen at once to be contracted, and being intumefied, to be abbreviated.

For the promoting the recess of the Spirits out of the fleshy Fibres into the Tendons, whilst the Muscle is contracted, the membranaceous Fibrils, which every where cut cross wise the fleshy, and thickly stick between, seem to help. The texture of these never to be enough admired, is better perceived in a Muscle endued with large Fibres, *viz.* an Oxes being boiled to a tenderness. For in such a one, if gently opening the fleshy Fibres, you shall draw them one from another through the whole series, you shall see little Fibrils, like hairs, most thickly extended upon every one of those Tubes, which little Fibrils, not only close and knit together the fleshy Fibres, but also lying upon every one of their series, and cutting them in oblique Angles, they also are all carried parallel, from Tendon to Tendon, in an opposite site to the fleshy: therefore whilst the Muscle being contracted, the fleshy Fibres do swell up, the Fibrils embracing them, that they may give place, are somewhat distended; then as soon as the swelling up remits, these returning to their wonted straitness, press together every where the flesh, and the Spirits being expelled on either side, they reduce them to their pristine length. It makes for this, that whilst the Muscle is contracted, the Spirits inflowing through the Nerves, depart from their membranaceous Fibrils; wherefore these being empty and lax, are able more easily to be distended; but whilst the Muscle is relaxed, the Spirits again entring the Fibrils, fill them, and that they may the better bind the fleshy Fibres, they make them shorter.

The Instincts of Motions, to be obeyed by the Muscles, so delivered by the Nerves, are, being sent either from the Brain, performed at the command, and with the knowledge of the Appetite; or from the Cerebel, according to the Laws of Nature, for the most part unknown to us. But besides, sometimes the Muscles are carried beyond, or contrary to the pleasure of the Appetite or Nature, into irregular motions, *viz.* violent and convulsive, and that happens after various manners and for divers causes. Concerning these, some time since discoursing more largely, we have shewn, that from thence do arise many kinds and differences of convulsive motions; as the Spasmodick matter being somewhere fixed, doth subsist either about the beginnings, middle, or ends of the Nerves; or because the same thing being wandring and loose, runs about here and there through the whole passages of the Nerves, and so variously transfers from place to place convulsive distempers. But besides these divers kinds of Convulsions, which are excited by reason of some evil or vice sticking somewhere to the Nerves themselves, this our Myology or Doctrine of the Muscles, hath discovered some Convulsions of another kind arising from the Muscles being chiefly affected.

For indeed we must advertise you, that the animal Spirits, disposed among the Muscles themselves, by reason of a taint or evil derived from the Brain, or from the Blood, or perhaps oftentimes from both together, are infected with certain heterogeneous Particles, by reason of which they cannot rest or lye quiet in their Cells; but being always unquiet and restless, leap out of their own accord from the tendinous Fibres into the fleshy, and so oftentimes produce frequent and cruel Convulsions. But this we have observed to be done after a twofold manner, *viz.* first, for that the Spirits being burdened with an elastick Copula, remain not long within the Tendons, but leaping out from thence into the fleshy Fibres, induce frequent Convulsions of a Muscle, but short, and as it were by leaps; or secondly, because the animal Spirits, although they sometimes lye quietly within the Tendons, yet being inordinately snatched into the flesh, and there cruelly exploded, they cannot be presently repressed, brought into order, or reduced into the Tendons, but whether we will or not, they persist a long while expanded, and so bring forth a long and very painful contraction of the Muscle. Which kind of Spasm, sufficiently known, we vulgarly term the Cramp.

The former distemper (called the Convulsive Leaping) is familiar both to malignant Feavers, and to the Scurvy. As to those, we have ordinarily known, when either no Crisis, or an evil one is obtained, that heterogeneous Particles from the blood and nervous juyce very much vitiated, are not only laid up in the Bowels, (whose dispositions and functions they pervert) but almost every where in the Muscles; and there growing to the Spirits, do affect them with a certain madness, so as they cannot continue peaceably together, or rest within the Tendons, but being divided and distracted one from another, leap out from thence by bands into the flesh, and there stir up the

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leffer and most frequent Spasms or Convulsions. In like manner, by reason of the Spirits inhabiting the Muscles, being burdened with an elastick Copula there growing to them, some labouring with an inveterate Scurvy, cannot contain their limbs in the same site or position, but are necessitated sometimes to extend the hands or feet, sometimes to fling them about here and there, to transfer them variously, and sometimes to subdue their madness by running, leaping, or other hard labours.

Treating some time since of Convulsive Motions, we did almost wholly omit the Aetiology of the continuing Spasm or Tetanism, as a thing which depended upon the Doctrine of the Muscles, to be treated of afterwards: Then we only hinted, that the contraction of that kind did arise in one Muscle, because its other Antagonist was resolved or loosened, which indeed oftentimes happens in the face and some members; in which, whilst the parts upon one side are troubled with the Palsie, those opposite on the other, as it were loosened in the Reins, are too much contracted. Notwithstanding this kind of Spasm for the most part is without pain; besides, this is not easily or presently passed over or cured no more than the Palsie, which is the cause of it.

Therefore as to what belongs to the formal reason of the Spasm, called in our Idiom the Cramp; every one labouring with this distemper, perceives in himself one or more Muscles to be most strongly and involuntarily drawn together, and they being for some time so highly distended, remain as it were stiff; and in the mean time, for that the fleshy Fibres being cruelly contracted, do violently haul or pull either Tendon, to wit, that which is fixed to the immoveable part, perhaps no less than the other part to be moved, they cause a most troublesome pain. But sometimes this Spasm being excited, by reason of the animal Spirits carrying themselves out impetuously into the fleshy Fibres, doth not cease until the same Spirits being returned into the Tendons, suffer the flesh to be relaxed; therefore its nearest causes will be both the greater impetuosity of the animal Spirits among the fleshy Fibres, with which they leap thither unbid; and also their long continuance or stay, for that they return back more slowly and difficultly into the Tendons. For the secondary causes may be reckoned, both the evil disposition of the animal Spirits, and also the evil conformation of the Tendons, *viz.* sometimes this, sometimes that, and not seldom both together.

As to the former; this distemper, as other Convulsions, seems to arise, for as much as the animal Spirits, being burdened with heterogeneous Particles or an elastick Copula, at length being irritated, they are incited to the striking of it off: which notwithstanding, being thick and viscous, and for that cause more tenacious, is not soon nor easily shaken off, but that the Spirits being still provoked by the same, and shut up within the fleshy Fibres, are longer detained in the expansion: which thing perhaps happens not so much unlike, as when water and air being joyned together, make a bubble; which, if it be made of water, wherein a little Sope is put, is more tenacious, much more large, and continues longer than that made only of mere water. So we observe, that they who abound in thick and tartareous humours, are most obnoxious to these kind of Cramps, and besides, that they who presently sleep upon drinking or eating gross meats, after full eating, and especially after a large and plentiful supper, do suffer most cruel assaults of this disease; but sometimes the Tendons themselves are found to be in the fault, for that they being too hard bound together or obstructed, they do not easily admit the Spirits returning from the fleshy Fibres. The obstruction of the Tendons is the cause, that Gouty and Scorbutick people, whose Tendons salt and tartareous humours easily run into and obstruct, are wont to be cruelly tormented with these kind of painful Cramps: But that the constriction of the Tendons doth sometimes bring forth this disease, appears by this, for that some Women with Child, (as I have been often told) about the latter end of their Time, by reason of the Muscles of the Abdomen being too much extended, are wont to be troubled with frequent Cramps, only in the bottom of their Bellies. For the illustrating of this Pathology we will add this following Case.

A Noble Woman, young and fair, some time since obnoxious to Hysterick distempers, and now above two years ago to Convulsive, and in a manner Epileptical; of late, by reason of the frequent and most cruel assaults of the disease, she became also Cachectical and Paralytical, that at length her Abdomen was distempered with an Ascites, and her Legs with a waterish Tumor, and lastly, all her lower parts, below her Hips, were deprived of motion; hence, as often as the Convulsive fits infested her, she was wont, not now to move her body or members here and there, but sometimes

times these, sometimes those parts being snatched with the Tetanism, were variously bent and twisted about, that in the mean time, she her self sitting in her Bed or Chair, remained stiff and almost immoveable. It is not long since, that seeing the whole manner of one of these Fits, I observed, not without great admiration, divers sorts of turns and changes of alterations of the Spasms. At the first assault, her eyes being turned about swiftly hither and thither, she was presently taken with insensibility, then by and by her head being turned and contracted of one side, presently her arms and legs at once became stiff, and all her Joynts, sometimes of one side, sometimes of both, were bowed or stretched out: perhaps after four or five minutes these Spasms both in her Head and Limbs remitting, of a sudden others, for the most part opposite, followed; which being often finished in the like space, others far different did arise, and so for two or three hours, longer Spasms almost of every kind and fashion, being excited through her whole Body, followed upon one another; so that her head being convulsed or pulled by turns from the right to the left, and contracted before and behind, yea and all her Limbs being bent inwardly here and there, or distended outwardly in the Course of one Fit, she exhibited all sorts of Convulsive gestures. When at any time the Spasms of one sort continued longer in the Head or Limbs than usual, it was the custom of the Servants about her to blow up strongly into her Nostrils the Fume of Tabaco; which being done, as the Spirits recovered within, the present Spasms immediately remitted, but upon them others of a new kind succeeded. Of late the Legs of this Lady were so debilitated by being loosned, that she could neither go nor stand, yea her Tendons under either Ham, being made tumid and shorter, were so contracted, that she could not stretch out her Legs straight.

Concerning the case of this sick Noble Lady, it may be demanded, wherefore upon the first coming of the Fit, no throwing about of the Body or Limbs, as is wont in most Convulsive or Epileptical people, but only continued Spasms or Convulsions variously translated from one part to another, and so others, did arise? For the solution of this, we say, that the Spasmodick matter is not only heaped up in the Brain and Nerves, but also in the Muscles themselves, and grows to the Spirits inhabiting the Tendons: And as that matter is tenacious, and the Spirits weak, and unable for the striking off quickly or easily such a Copula; therefore as often as these being irritated, do leap out of the Tendons into the flesh, the Muscles being first possest, they cause strong and long Contractions; in the mean time, other Muscles, especially their Antagonists or opposites, being hindred and bound up from motion, until the Convulsions of the former are remitted; hence the Members, however convulsed, are not moved out of their place, because the moving or carrying of the Body, or any Members, is not performed but by the help or duty of many Muscles, whilst some of them either rightly cooperate with others, or at least obey them, to wit, so that some respective Muscles, observing due cooperation, are contracted at once, then those being loosned, the contraction of others immediately succeeds. But if they which are unequal and unlike, are at once contracted and strongly convulsed, and so continue long, so that other Muscles in the mean time cannot be contracted, there will be a necessity for the members bent or extended here and there, to remain as they are wholly stiff. But that the present Convulsions were always remitted by the blowing the smoke of Tabaco up her Nose, the reason is, because the region or some part of the bodily Soul being vehemently affected, if by chance a new passion equally violent be brought upon another part, the first is presently abolished or ceases: For in truth, it appears by constant observation, where-ever the greater or fresher trouble is, that thither greater plenty of Spirits presently flock and make a tumult: wherefore any new irritation being excited in the Brain or its Meninges, whatsoever others were begun outwardly among the Muscles, immediately vanish or are obscured; then as soon as this fresh trouble is passed over, Convulsions outwardly arise forthwith again, but in other parts where more heaps of Spasmodick matter lye not yet consumed. But that long continued Spasms do arise, either by reason of the Spirits being burdened with a more tenacious Copula, or by reason of the Tendons being obstructed with a viscous or tartareous matter from either or both, it appears from hence, because this disease increasing (as in the case of this Noble Lady) the Tendons are at length so shortned by the more plentiful heaping up of the morbidick matter, that they become stiff and shorter, and for that reason they hardly or not at all grant any place to the Spirits for the constant performing of the motive function.

Thus much for the Muscular Motion, both natural and convulsive, and the reasons

sons of both, which we have proved with what diligence we were able, and by Anatomical Experiments: But if any one shall object, that they are not very firm, because we have noted in the cutting up of live Creatures, that the Heart and Muscles of Respiration and the fleshy Pannicle, after that the Nerves and Arteries are cut away, do continue for some time their turns of Contraction and Relaxation, whence it is argued, against our Hypothesis, that their motions do not depend upon the constant influx of the blood and animal Spirits; it will be plain to return this Answer, That in those about to dye, it sometimes happens so, because the Soul being then distracted and drawing near to dissolution, all the implanted Spirits at once being cut off from the commerce of those influencing or flowing in, do of their own accord exert themselves, and perform (as long as they are able) their wonted motions; which being continued for a little space only, need not the subsidy or assistance of fresh forces, because the veterane, till they are quite worn out, perform their wonted tasks; yea also the old sanguineous Copula, till it be wholly consumed, receives and lets go their embraces with a constant change: But this more rarely succeeds in other Muscles subject to the Empire of the Appetite, and wont only to be exercised as occasion served.

Moreover, as we have affirmed, that the Instinct for the performing of Motions is brought altogether through the Nerves from the Head to the Muscle, and as every Trunk of the same Nerve, being oftentimes broken into many shoots, variously distributing them, sends it to many destinated Muscles, it may very well be doubted, how the animal Spirits, conveying the Symbol of the motion to be performed with a certain choice, do actuate only these or those branches apart from other branches of the same, and do not indifferently enter all the branches or shoots of the same; to wit, as the blood passes through the Trunk of the Artery, and all its ramifications equally. The most Learned *Regius*, that he might solve this knot, supposes in the Nerves some little doors, like to those which are found in musical Organs, the apertures whereof admit the Spirits to these or those parts especially, the rest being shut up. But he ought to have shewn, if not the little doors themselves, yet at least by what instinct and by whose direction sometimes these, sometimes those are locked up, and others opened. But in truth, this may rather be said, that all the shoots of the Nerves and lesser branches remain distinct and singular among themselves from the parts to which they are inserted, even to their beginnings; so that a peculiar tract of the Spirits or way of passage lyes open, from the Brain and its medullary Appendix, to every Muscle and nervous part; for in truth, although the Nerves, according to their beginnings, may seem to arise from the greater Trunks; yet it will easily appear, if you shall open the trunk and those branches, that in them many little Nerves, only like hairs, for the sake of a better conduct, are collected together in the same bundle; yea, the coverings being separated, you may follow oftentimes the little Nervulets, and those single to the respective parts and members, to which they are destinated.

But in the mean time, although there be singular passages or chanelles of the animal Spirits of most Nerves, distinct among themselves; yet some do variously communicate with others through the branches and shoots sent on either side; which indeed ought to be so made, that when many Nerves together, are required to some motion of a Muscle equally, all these, by reason of the commerce mutually had between themselves, might conspire in the same action; hence, in some motions of the members, as in the striking of a Harp or Lute and other complicated actions, many Muscles cooperate with admirable celerity; so that, although many be employed at once, they perform their task severally without any confusion. Besides, there is need for the Nerves to communicate mutually among themselves, because of the Sympathetical motions of the members and of some of the parts, for neither for any other cause is the Nerve of the Diaphragma inserted into the brachial branches, or those belonging to the Arms, than that the exercise of living Creatures, especially in running or flying, might be proportionate to the tenour of Respiration. Hence it also proceeds, that in any passion, the Præcordia being bound up or dilated, the countenance and aspect of the face, yea and the gestures of the hands and members are pathetically figured. We have proposed sufficient Instances of this sort in our particular History of the Nerves, so that we need not here add any thing more.

What remains for the illustrating our Myology or Tract of the Muscles, we have taken care to have added, *viz.* four Figures, which may represent to the life both the exterior and interior true and natural faces or appearances both of a simple and compounded Muscle.

Fig. III.

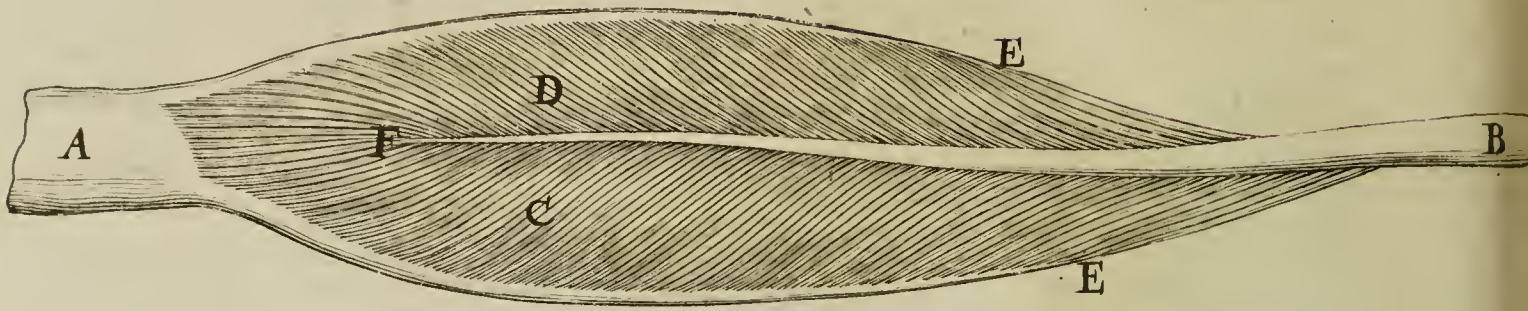


Fig. IV.

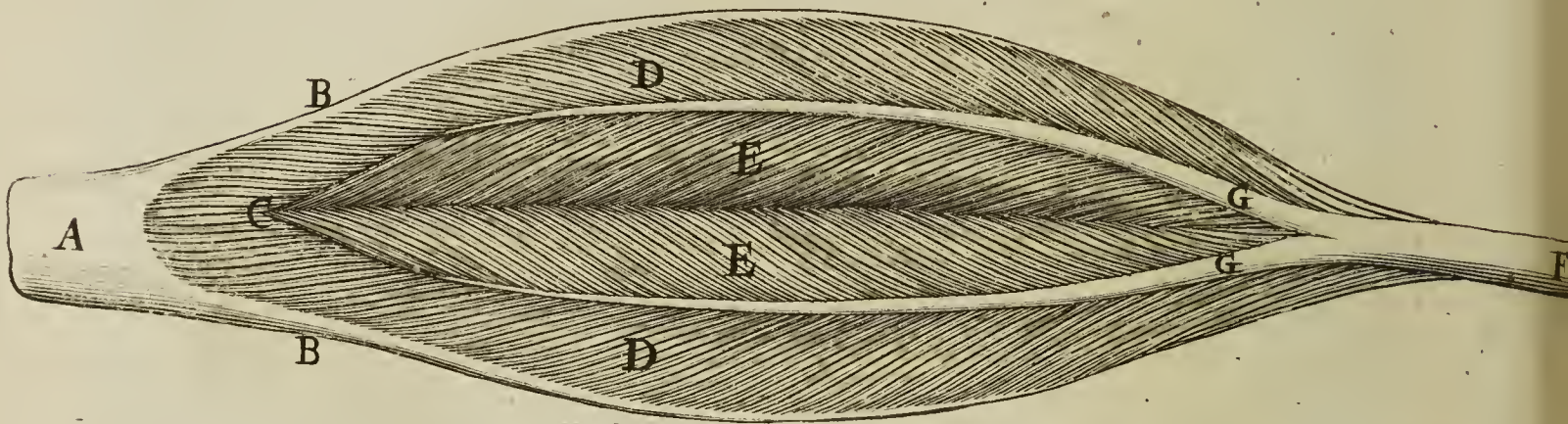


Fig. I.

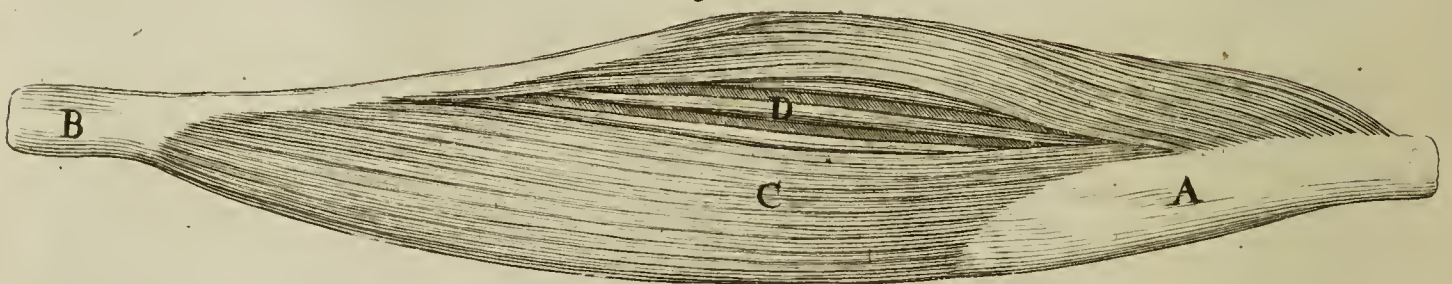
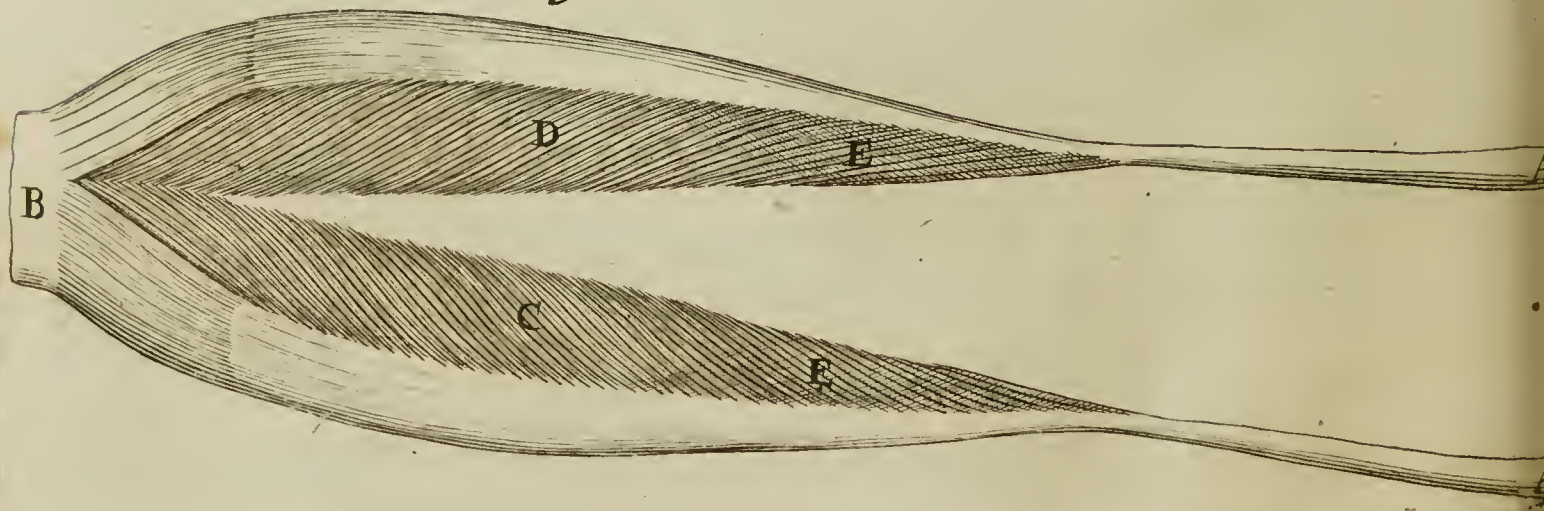


Fig. II.



The Explication of the Figures.

The First Figure

Shews a simple regular Muscle, described according to its natural appearance, in the Belly of which the fleshy Fibres being opened, are diduced one from another, that the membranaceous Fibrils may be the better beheld.

- A. The right Tendon.
- B. The left opposite Tendon.
- C. The fleshy Belly; all the fleshy Fibres of which lye one by another equal and parallel, but in even and oblique Angles between either Tendon.
- D. The aperture of the fleshy Fibres, which being drawn aside, the membranaceous Fibrils, thickly crossing them, appear.

The Second Figure

Shews a simple Muscle cleft in the middle, after the Tendon being cut off, and portions of it pulled away, that the interior series of the fleshy Fibres, or their commixtures or mingling with the Tendons, may appear.

- AA. The right Tendon being placed above, both portions of which divided, do in some measure appear.
- BB. The left opposite Tendon placed below, either portions of which divided, lye hid for the most part under the Flesh, those towards the edges being only conspicuous.
- CD. Portions of the fleshy Belly divided and separated, which before (this being laid upon that) did cohere, in either of which all the fleshy Fibres proceed equally, and in like manner obliquely from one Tendon to another.
- E. Some membranaceous Fibrils represented, thickly crossing the fleshy Fibres.

The Third Figure

Exhibits a certain Muscle less compounded, to whose two fleshy Bellies two compounded Tendons also (equal to four simple ones) are destinated.

- A. The exterior compounded Tendon, embracing either side of the fleshy Fibres, which being almost only conspicuous on the edges, lyes hid for the most part under the Flesh.
- B. The interior compounded Tendon, entring into the middle of the Flesh, which receives on both sides the fleshy Fibres, sent from either side of the exterior Tendon.
- C. The first Belly of the fleshy Fibres, all whose equal and parallel Fibres lye between the opposite sides of the Tendons in oblique Angles and equal.
- D. The second Belly of the fleshy Fibres, all whose Fibres being in like manner formed, are beheld in the same as in the other Belly.
- EE. Both extremities of the exterior compounded Tendon.
- F. The extremity or end of the interior compounded Tendon, the like to the other being opposite, at an equal distance from the end of the Muscle.

The Fourth Figure

Shews a regular compounded Muscle, divided and opened in the middle, so that the interior face of either Belly may appear.

- A. The exterior compounded Tendon cleft into four parts.
- BB. Portions of one side of the divided Tendon separated from the other.
- C. Portions near sited, of the other side of the divided Tendon, which for the greatest part lye hid under the flesh.
- DD. The flesh of one Belly also divided, and separated one far from another.
- EE. The flesh of the other Belly also divided, and placed near one another.
- F. The interior compounded Tendon entring the middle of the Flesh.
- GG. Portions of the same Tendon divided, and with portions of the Bellies, which they receive, separated apart.

THE ANATOMY OF THE BRAIN.

*The Authors Epistle Dedicatory to his Grace Gilbert
Archbishop of Canterbury, &c.*

Most Honourable Prelate,

ONCE more your *Sidley* Professor and your Servant (the more happy Title) flings himself at Your feet, with this only Ambition, that he might render something of Thanks for Your Kindness and benefits, and that our Labours might chuse such a Patron, that might give Credit to the Author. But I fear, lest by my repeated Duty I may seem troublesom, and no less in acknowledging Your Benefits, than others in suing for them: But so great is my Gratitude, and so exceeding is Your good Nature, that they cannot be crowded into a little compass, much less wearied out or drawn dry.

But there is another Reason, which if it doth not command what I do, may at least excuse and defend it. For when I had resolved to unlock the secret places of Mans Mind, and to look into the living and breathing Chapel of the Deity (as far as our weakness was able) I thought it not lawful to make use of the Favours and Patronage of a less Person, neither perhaps would it have become me. For You indeed are He, who most happily presides (both by Merit and Authority) over all our Temples and Sacred Things. Therefore after I had slain so many Victims, whole Hecatombs almost of all Animals, in the Anatomical Court, I could not have thought them rightly offered, unless they had been brought to the most holy Altar of Your Grace.

I am not ignorant, how great the labour is that I undertake: For it hath been a long while accounted as a certain Mystery and School-house of Atheism to search into Nature, as if whatever Reasons we grant to Philosophy, should derogate from Religion, and all that should be attributed to second Causes, did take away from the first.

But truly, he doth too much abuse the Name of Philosophy, who considers the wheels, curious frame, setting together, small pins, and all the make and provision of a Clock, by which invented Machine the course of the Time, the orders of the Months, the changes of the Planets, the flowing and ebbing of the Sea, and other things of that kind, may be exactly known and measured, if that at length, when by this his search and consideration,

The Epistle Dedicatory.

deration, he hath profited himself so much, he should not acknowledge the Artist, to whose Labour and Wit he owes all those things.

I am sure I am of another mind and opinion, who look into the Pandects of Nature, as into another Table of the Divine Word, and the greater Bible: For indeed, in either Volume there is no high point, which requires not the care, or refuses the industry of an Interpreter; there is no Page certainly which shews not the Author, and his Power, Goodness, Trust, and Wisdom.

In the mean time, there is no right Weigher of things that can lay to our charge as a fault, that we have studied these Rolls of Nature, because some Atheists may be made thereby; which may be objected to the studies of Divines in Sacred Letters, that from their provision Hereticks have taken their Arguments and Opinions, and turned them against them and Godliness.

That I may deal freely, whoever professes Philosophy, and doth not think rightly of God, I do judge him not only to have shaken hands with Religion, but also with Reason, and that he hath at once put off Philosophy as well as Christianity. Therefore I desire, that all mine may be tryed and approved, no less by the demonstration of Piety and Canons of the Church, than by the Rule of Experience and Knowledge, to which I keep: Neither do I intreat and respect only the *Mecænas* of humane Arts, but also the Primate and chief of Divine, whilst I openly profess my self, with all due observance,

Y·O·U·R G·R·A·C·E·S

Most humble and obliged Servant,

T H O. W I L L I S.

T H E

The Preface to the Reader.

THE Romans sometimes promised to themselves an Empire, an Eternity by the happy Augury of an humane Head being turned out of the Glebe; neither could they persuade themselves, that the Capitol should be the Head of the World; unless it had been built upon the Skull of a Man. I do not think of Empires in Arts, nor do I promise to myself Triumphs by overcoming the World of Letters: But in the mean time, I had wholly frustrated those Illustrious Documents I had long since learned, unless with those Auspices I had laboured in Philosophy, especially the Natural.

For the Province, which I hold in this Academy, requiring that I should Comment on the Offices of the Senses, both external and also internal, and of the Faculties and Affections of the Soul, as also of the Organs and various provisions of all these; I had thought of some rational Arguments for that purpose, and from the appearances raised some not unlikely Hypotheses, which (as uses to be in these kind of businesses) at length accrued into a certain System of Art and frame of Doctrine. But when at last the force of Invention being spent, I had handled each again, and brought them to a severer test, I seemed to my self, like a Painter, that had delineated the Head of a Man, not after the form of a Master, but at the will of a bold Fancy and Pencil, and had followed not that which was most true, but what was most convenient, and what was rather desired than what was known. Thinking on these things seriously with my self, I awaked at length sad, as one out of a pleasant dream; to wit, I was ashamed that I had been so easie hitherto, and that I had drawn out for my self and Auditors a certain Poetical Philosophy and Physick neatly wrought with Novity and Conjectures, and had made a Fucus as it were with deceits and incantations for either of us.

Wherefore all delay being laid aside, I determined with my self seriously to enter presently upon a new course, and to rely on this one thing, not to pin my faith on the received Opinions of others, nor on the suspicions and guesses of my own mind, but for the future to believe Nature and ocular demonstrations: Therefore thenceforward I betook my self wholly to the study of Anatomy: and as I did chiefly inquire into the offices and uses of the Brain and its nervous Appendix, I addicted my self to the opening of Heads especially, and of every kind, and to inspect as much as I was able frequently and seriously the Contents; that after the figures, sites, processes of the whole and singular parts should be considered with their other bodies, respects, and habits, some truth might at length be drawn forth concerning the exercise, defects, and irregularities of the Animal Government; and so a firm and stable Basis might be laid, on which not only a more certain Physiologie than I had gained in the Schools, but what I had long thought upon, the Pathologie of the Brain and nervous stock, might be built.

But for the more accurate performing this work, as I had not leisure, and perhaps not wit enough of my self, I was not ashamed to require the help of others. And here I made use of the Labours of the most Learned Physician and highly skilful Anatomist, Doctor Richard Lower, for my help and Companion; the edge of whose Knife and Wit I willingly acknowledge to have been an help to me for the better searching out both the frame and offices of before hidden Bodies. Wherefore having got this help and Companion, no day almost past over without some Anatomical administration; so that in a short space there was nothing of the Brain, and its Appendix within the Skull, that seemed not plainly detected, and intimately beheld by us. After this, when we entred upon a far more difficult task, viz. the Anatomy of the Nerves, then very much appeared

The P R E F A C E.

peared the plainly to be admired skill of this Man, as also his indefatigable Industry, and unwearied Labour: For having prosecuted, with a most exact search, all the divarications, wandring on every side of the Nerve, how minute or small soever, and immersed, and variously infolded within other Bodies, and so turning over the Labyrinths of the Branches, and shoots of every pair, far and near diffused, he drew out with his own hand the Schemes, Images, or Draughts of them, and also of many passages of the Blood, as they appear in this Tract; which indeed, that they might be faithfully and most exactly shewn, without any falsity or error, he caused, that no Table might contain scarce any line or the most light passage, whose conformation and exact habitude he had not found proved by the marks or inspection of many Animals for that purpose killed.

Besides the helps brought me by his most skilful dissecting hand, it becomes me not to hide, how much besides I did receive from these most famous Men, Dr. Thomas Millington Doctor in Physick, and Dr. Chr. Wren Doctor of Laws, and Savill Professor of Astronomy; both which were wont frequently to be present at our Dissections, and to confer and reason about the uses of the Parts. Besides, the former most Learned Man, to whom I from day to day proposed privately my Conjectures and Observations, often confirmed me by his Suffrage, being uncertain in my mind, and not trusting to my own opinion. But the other most renowned Man, Dr. Wren, was pleased out of his singular humanity, wherewith he abounds, to delineate with his own most skilful hands many Figures of the Brain and Skull, whereby the work might be more exact.

But although instructed by these helps, and as it were hem'd in by the plentiful assistances of these Illustrious Men, I come forth on the Stage, I presume I shall not be however safe from calumny, and free from blame and most just reprehension: because here is inquired into the recesses and most inward dens of the Brain, and its depending parts as it were shut and sealed up; concerning the certain uses of which, scarce any thing may be brought forth, but that, as it may be published and shewn, for the Judgments of the more Learned, so it may be carpt at and torn by the opprobries of detractors. In other parts, where matters appear to the Senses, we do not so easily run upon errors. For in most of the Viscera and Vessels, the Contents and contained humors, as also their passages within the larger Cavities of the containing parts, are discerned by the sight: But in the Brain and Nerves, neither the rushings on or impressions, viz. the Animal Spirits themselves, nor their tracts or footsteps, can any ways be seen. Wherefore to explicate the uses of the Brain, seems as difficult a task as to paint the Soul, of which it is commonly said, That it understands all things but it self: for in truth, the unwearied labour of the Brain beholds or searches the hidden places of other Bodies, in the mean time the æconomy or regiment of its own Family and Kingdom being wholly hid and unknown.

But what we profess to be performed by us in the following Tract, and hope for the future from the help or labour of others, is chiefly this; to wit, that we have not rashly described the parts themselves, of which the Anatomy is instituted, but that we have with diligent care and great trust collected the various appearances and Arguments of Observations by a manifold Dissection. Which things, if you shall delineate out of those Sentences and granted Decrees, as it were to a Mathematical Rule, and from thence would collect a Theory, as yet lame, and that may not appear absolute in all its numbers, no doubt but that a longer time, and the getting of more Observations may give it a more perfect form, that Antiquity may not have said altogether in vain, That Minerva was born from the Brain, Vulcan with his Instruments playing the Midwife: For either by this way, viz. by Wounds and Death, by Anatomy, and a Cæsarean Birth, Truth will be brought to Light, or for ever lye hid.

T H E

THE ANATOMY OF THE BRAIN.

CHAP. I.

The Method or Anatomical Administration of Dissecting the Brain is proposed.

AMong the various parts of an animated Body, which are subject to Anatomical disquisition, none is presumed to be easier or better known than the Brain; yet in the mean time, there is none less or more imperfectly understood. All of it that appears, and is commonly described in the forehead or forehead, is beheld almost at a sight or two after some rude cutting up; but if you seek what lyes hid in the recesses for that end, new bosoms and productions of Bodies, before hid, are every where laid open: yea the parts of the Brain it self are so complicated and involved, and their respects and habitudes to one another so hard to be extricated, that it may seem a more hard task to institute its perfect Anatomy, than to delineate on a plain, the flexions and Meanders of some Labyrinth: Because, as we are not able to estimate the measure or to paint forth the pattern or draught of the frame of this, so neither of that, unless the bulk or substance of the subject be first searched to the bottom, and its frame broken into pieces. Hence it came to pass, that the old Anatomists in dissecting the Brain, not sufficiently attending what was placed first, what second, and what after that in the order of Nature, cut its Globe as it were into slices or parts, and the Phænomena arising by chance from such a dissection, they easily esteemed for true parts of the Brain; when yet in the mean time, by others from a dissection otherwise made, the parts and processes of it appear far different from the former. The reason of which is, because the substance or frame of the Brain and its Appendix lyes so within the Skull, that there are many swellings or tuberos risings, with several tails or little feet compacted together: all which, although distinct one from another, and are endued with figures diversly expanded; yet they, that they may be contained in a lesser room, are thrust as it were into the same Globe, and so complicated among themselves, that it is a hard thing to find out where the beginning and end of the Brain, as also where the limits and partitions of the near adjoyning parts do remain; further, that the several parts of the Encephalon so complicated, may retain their site, nor presently being loosned one from another, may spring forth, they are knit together into due foldings, with Fibres and Membranes stretched out from part to part. And as often as the substance or bulk of the Brain so conglobated or rolled together is cut, there is as often a necessity that the slips being cut, the portions of divers parts cleaving together, are carried away with them. Wherefore that a true and genuine description of the Brain might be shewed before its substance and continuity is dissolved, before all things its whole frame or substance ought to be explicated, and the knitting of the Membranes being wholly loosned, the several parts ought to be turned over and stretched forth into their proper dimensions. By what means these things may be done, and by what

Method the dissection or Anatomical administration of the Brain may be best performed, ought here in the first place to be shewn; then these things being first done, we will more largely deliver the Description of the Brain, together with the use and action of its several parts.

That the perfect knowledge of the Brain and its parts may be gained, it is necessary not only to dissect and look into mens Heads, but all other kind of living Creatures heads: for besides, that the humane Heads or Bodies are not so readily to be had, that one may from day to day behold the Brain and its frame, and carefully consider the situation of the parts, and search one after another their respects, habitudes, and dependencies; besides also, the immense bulk of an humane Head is in it self an hindrance, whereby its most intricate frame and various recesses and Appendices are the less accurately discerned and investigated: all which being reduced into an Epitomy, are plainly represented more commodiously in the dissection of Beasts. Wherefore when the form and composition of the Brain in a Dog, Calf, Sheep, Hog, and many other four-footed beasts, were little different (the magnitude only excepted) from the figure of the same, and the disposition of the parts, in a man, I was the more satisfied to compose a certain Anatomy of the Brain by the frequent dissection of all sorts of living Creatures. And in this imployment, for that I shall shew the communities and differences which the subjected parts obtain in various Animals, compared among themselves, and with Man; certainly from such a compared Anatomy, not only the faculties and uses of every Organ, but the impressions, influences, and secret ways of working of the sensitive Soul it self will be discovered. Concerning the Heads of living Creatures, in the dissection of which it happened for us chiefly to be exercised, it was observed, as to the chief parts of the Head, that there was a notable Analogy between Man and four-footed Beasts, also between Birds and Fishes: For when the first Inhabitants of the new-made World were produced, as one day brought forth Fowl and Fishes at once, another in like manner Man and four-footed Beasts; so there is in either twin species a like form of the Brain; but between that Child of the former, and this of the following day, there is found a great difference as to those parts. For as much therefore as Men and four-footed Beasts have got more perfect Brains, and more alike among themselves, we have ordered our Observations from their Inspection: Then afterwards we shall deliver the Anatomy of the Brain in Fowl and Fishes. And here first concerning the Heads of Men and four-footed Beasts, (as we hinted but now) we will propose a Method of Dissection it self, or of Anatomical Administration, and will at once recite all the parts one after another, and as it were in a compendious Catalogue; then we will by and by more largely draw out the Particles of the Brain and of its Appendix, so shadowed, in a short Table, and will design their uses and actions for the exercise of every faculty.

When therefore we had in our hands the Head of a Man, or Dog, Calf, or Sheep, its more outward coverings were taken off; concerning which, as they are well enough known, we are not at all solicitous: then the covering of the Skull being divided by a Saw or Instrument, and taken away, on every side the bones are broken off with a pair of Scissers or a Penknife to the Basis of the Skull, that so the Contents might, as much as may be, be all made plain or open to the Spectators. What therefore comes first in view is the hard Meninx including all the rest with a common covering. This Membrane outwardly and above is knit to the Skull in divers places, especially about the Sutures; but indeed about the foot or Basis it most strictly cleaves to the bones, so that it cannot easily be pulled away. Inwardly (or in its hollow superficies) it is lax and loose enough, unless that nigh all its bosoms by the insertions of the Veins, and in the Basis of the Skull by the Arteries and the Nerves it is tyed to the *Pia Mater*.

This same Membrane between the *Interstitia* or division of the Brain, and besides of the Cerebel it self insinuating it self deeply on one side, and rising up again on the other, leaves some duplicatures or infoldings, in which, being shut up above by the increase of the same Membrane, Cavities, which they commonly call Bosoms, are formed: to wit, by this means, almost the three first bosoms are constituted; but the fourth is a smooth and longish, and also hollow process of the same Membrane, which is sent through the *Interstitia* of the Brain, nigh the end of the callous body, even to the pineal *Glandula*. The Cavities of the greater Bosoms are severed in many places, as it were into little Cells; as it seems for that end, that the blood
passing

passing so through the various turnings in those ends, may be hindered from a more rapid motion.

Besides, this Meninx or Film of the Brain admits two Arteries from either side; one conjugation of which arises not far from the Carotick Arteries through the holes of the Cuniform bone, but the other from the bone of the Forehead: all which indeed being diffused through the exterior superficies of the Membrane, water it; but are terminated, partly in the Skull, especially nigh the Sutures, whither they convey the blood, and partly in the bosoms, where, what is superfluous is laid up. Moreover, these Arteries perforate the hard Meninge in several places on the top of the Brain (as *Webfer* observes) and impart some shoots to the *Pia Mater*. Lastly, the exterior superficies of this Meninge is no where planted with so many shoots of Veins as Arteries; but from its four Bosoms (which are the veinous Receptacles of the blood) many Veins go out through the interior superficies of this Membrane, which being inserted in the *Pia Mater*, are presently dispersed through its whole compass, and the same sliding down on every side from the bosoms, meet every where the Arteries ascending from the Basis of the Head, and being intermingled with them, constitute the manifold infoldings of the Vessels.

That these may be the better beheld, after the Arteries are sufficiently noted, let the hard Meninx be cut round near the border of the broken Skull; then let whatever of it serves for a covering and partition to the Brain and Cerebel, be lifted up, that the goings out of the Vessels, viz. the Veins and their distributions into the *Pia Mater* may be considered; which being afterwards broken asunder, let the Membrane with its bosoms be wholly taken away; but the reliques of this Membrane, which stick to the bones at the bottom of the Skull, should be separated; so that the whole frame or substance of the Brain and its Appendix may be somewhat elevated, and moved here and there, be every where conspicuous, and at length taken from the Skull. But that these things may be performed, you must begin from the anterior or fore part, where the bone of the Forehead separates it.

Therefore if the prow of the Brain, hid under this bone, be a little lifted up, the mammillary processes come presently in sight, together with the smelling Nerves hanging to them; which being dissected near the insertion, there will appear an hollowness in either process. These are large and round, also full of clear water in Calves: but in either smelling Nerve a manifest Cavity is found continued on either side to the anterior Ventricles of the Brain, to which if a Pipe be put and blown into, presently the whole substance of the Brain will swell.

Next the smelling Nerves about the Cocks-comb two small Arteries are seen to arise from the Skull, and to be carried towards the *Interstitium* of the Brain, which in truth are branches of the Carotides, which are knit to the dilated Comb before; and from thence are seen to be reflected to the anterior Brain.

These Vessels being there dissected, the coming together and going out of the Optick Nerves follow, the trunk of which being cut off a little lower, the Tunnel, and out of both its sides the Arteries called Carotides, arising out of the Cuniform-bone, do appear; which are more clearly beheld, if the Brain be lifted up. These also being cut off, and the brain farther bent back, the moving Nerves of the Eyes presently shew themselves; and so from thence the other pairs of Nerves follow in order, that one pair of them being cut off, and the brain with its Appendix more lifted up, the next is still obvious to those beholding it, till all the Nerves arising within the Skull, and also the Arteries, both the Carotides, and the Vertebral being at length cut off, the whole frame of the Head may be taken out of the Skull.

But (that these Vessels may be described in the same order as they are met with in the cutting them up) two small Nerves follow after those moving Nerves of the Eyes, which, for a reason hereafter rendred, we call Pathetick. These Nerves higher than the rest, arising behind two round Prominences called *Nates* and *Testes*, (the Buttocks and Stones of the Brain) and bending down forward, and entring for a little space under the *dura Mater*, then coming out through the same hole, together with the former, from the Skull, are propagated into the sight of the Eye. This pair is called by *Fallopins* the eighth, by us the fourth.

Beneath these little Nerves, from both sides of the annulary protuberance, (which being sent from the Cerebel compasses the oblong Marrow) two Nerves of noted magnitude arise, which, after they have passed through the *dura Mater*, send forth another notable branch on either side straight down without the Skull, the other

branch, by a longer tract, passing through both sides the Skull near the Turkey Chair. These Nerves (as is shewn afterwards) having gotten a larger Province, are enlarged in the Palate, the parts of the Mouth and Face, and also their branches in the Nose and Eyes, yea they impart roots to the intercostal Nerve. We call this pair the fifth, commonly esteemed the third.

Nigh to the beginning of these, out of the lowest foot of the oblong Marrow or Pith, two lesser Nerves, endued with a single trunk, arise, which being dilated forward, and presently entring under the *dura Mater*, come out of the same hole with the moving Nerves of the Eyes, and are all carried into the balls of the Eyes. This pair is called by us the sixth.

Next to these Nerves follow the auditory or hearing pair, which indeed arises higher from the sides of the oblong Marrow, in what part the Cerebel is hanged to it, viz. nigh the lesser annular process; from whence it is immediately carried with a double process into the hole of the stony Bone: one of its branches is harder, serving chiefly for motion; the other altogether medullary and softer, as it were only destined to sense.

A little lower arises the wandring pair, which is commonly called the sixth. This seems to be made of many Nerves, many of which arise together; and to them comes another, endued with a greater trunk, which being brought from the end of the oblong Marrow, yea beyond this, out of the spinal Marrow, is united with the former. And so all being made like a bundle of Nerves, go out through the hole of the hinder part of the Head; through which also goes out the greater branch of the internal jugular Vein. This is by us called the eighth pair.

Under the wandring pair, almost out of the Basis of the oblong Marrow, another pair arises, consisting also of many Fibres, which going straight down, and being presently immersed in the *dura Mater*, comes forth again through a peculiar hole out of the Skull; then either Nerve, being inoculated into the trunk of the wandring pair, is presently bended back towards the Tongue. In a man, a peculiar protuberance grows above the oblong Marrow, out of which the beginning of this Nerve proceeds. This we call the ninth pair.

Below this, in the lowest part of the hinder part of the Head, out of the sides of the oblong Marrow, where it is about to go into the spinal, another pair, consisting also of many Fibres, arises; which tending towards the spinal Marrow, enters the *dura Mater* at the same place where the vertebral Artery ascends into the Brain; yet it arises out of the bosoms of the bones, but below the first Vertebra or Joynt, from whence it is carried into the Muscles of the hinder part of the Neck, so that it is doubtful, whether this pair ought to be called the last of the Skull, or the first of the Vertebrales.

When these parts, viz. the aforesaid Nerves and Arteries, both the Carotides and the Vertebrales, with the jugular Veins (by which the Encephalon is fastned to the foot or basis of the Skull) are cut off, and their ends stretched out as much as may be; either let them remain in the taken out substance or frame, whereby the beginnings of all the Nerves may be plainly noted; or the trunks of them being cut off near the roots, may be left in the holes of the Skull, whereby their goings out and distributions may be observed. The images of either Example are delineated in the first and second Table.

The business of Dissection being thus far brought, the residue of the Skull shews many things worthy consideration, of which we shall speak particularly afterwards. But first we ought to view thoroughly the taken out frame or substance of the Brain, together with its Appendix, and to examine all its appearances as they follow in the order of Dissection.

The substance or bulk being taken out, which is of a somewhat round figure or spherical, it exhibits to the sight in its superiour and convex part the Brain and Cerebel; but the oblong Marrow, with the utmost borders or edges of the superiour bodies, possesses almost all the basis or its lowest part. The thinner Meninx covers these three placed near, and the outward superficies of them all; nor doth it clothe the same loosely, but deeply insinuating it self into all their cavities and recesses, covers and binds them strictly. And as this Membrane is every where interwoven, with the folds of the Vessels, by its stretching out, it reaches the same to every part and portion, and so waters the whole with a sufficient afflux of blood. Here we must consider the Vessels of this Membrane and its protension.

As to the former, the whole superficies of the frame of the subject may be seen, covered with the infoldings of Vessels, as it were with a net admirably variegated or flourished, and its sight or aspect shews like the picture of a fruit-bearing wood; the Idea of which, the Vessels of the Brain more aptly represent, and are themselves seen better and more distinctly, if you first squirt into the Carotidick Artery some black liquor. The Vessels interwoven within the thin Meninge or *Pia Mater* are Arteries and Veins. The Arteries are four, *viz.* two Carotides and two Vertebrales. Out of either side of the Tunnel the ends of the cut off Carotidick Arteries shew themselves, the trunks of which ascending upwards, are presently diffused from either side into the anterior and posterior, or fore and hinder branch. Either pair of these inclining one towards the other, are mutually conjoyned: moreover, the posterior branches so joyned, are united with the Vertebral branches (growing together first into one trunk.) For the Vertebral Arteries, arising from the last hole but one of the Skull, fall at first divided through the sides of the oblong Marrow; then united in its basis, they go into a single chanel, which meeting with the hinder branches of the Carotides, (as it is said) it is joyned with them; and from that place of the joyning of them together, a noted branch ascends on either side under the edge or rim of the Brain, which being dilated upon the shanks or stocks of the oblong Marrow, is cleft or divided into very many small shoots like hairs, some of which ascend to the Glandula's placed behind the Cerebel, but the rest make the arterious part of the Choroeidal infoldings. The anterior branches of the Carotides, before they are united, send from themselves on either side a noted branch, which creeping upwards like a bounding River, distinguishes either Hemisphere of the Brain as it were into two Provinces; but after the aforesaid branches are united, presently departing again from one another, they are carried to the Prow of the Brain, and from thence bending back between its Hemispheres, they fall upon the callous body. All these Arteries, before and after their mutual joyning together, send forth shoots and little branches on every side, which do not only creep through and intimately bind about the utmost compass of its Sphere, but its Penetralia and more inward recesses, like the young branches of Vines. The ramifications or these sorts of branchings, both of the Carotides and of the Vertebrales, are shewn in the first Table, as they are found in a Man, and as in a Sheep in the second Table.

Moreover, this thinner Meninx or *Pia Mater* cloathing the whole Brain and its parts, as it receives the Arteries ascending (as hath been said) from a fourfold Fountain, so it is stuffed throughout with Veins, sent from four bosoms. These Vessels mutually meeting are complicated together, and almost every where constitute by their branches derived from both, and meeting one the other, and variously contorted among themselves, the net-like or retiform infoldings; which indeed are not only outwardly in the superficies, but in the dissection, where-ever you may separate one part from another, without breaking it, these kind of infoldings of the Vessels are to be found. Because, if you behold this frame, taken out of the Skull, collecting together the tops of all the turnings and the *Interstitia* in this Membrane, and covering them with the joynings of the Vessels, it will make the whole compass or frame of the Encephalon appear like a curious quilted ball. But if you go on to cast abroad this Sphere, and to separate the cleaving parts, knit together, of this Membrane, one from another, you will soon find, that this Meninx covers the gapings of the crevices or turning chaps of the Brain, binds the *Interstitia* of either moiety or Hemisphere, draws together the hinder part of the Brain, otherwise being lax and hanging loose, and compassing about every border of it, as it were with a Welt, knits it to the oblong Marrow: and what is the chief of all, the universal Cortical or shelly substance of the Brain (to wit, in which the animal Spirits are procreated) is covered over with this Membrane planted with most frequent infoldings of the Vessels; notwithstanding the interior superficies of the Brain being stretched out, (which being called the Callous body, is altogether medullary and white) is not cloathed with this Membrane; but instead of it many foldings of Vessels, commonly called Choroeides, are hung and as it were freely flow within its complicature. The reason of which is, because as this part, to wit, the callous body, is rather designed for the Circulation than for the generation of Spirits, therefore it admits not a more plentiful influx of blood: nevertheless, for as much as there is need of heat, whereby the Spirits may be there more easily circulated, the blood being moved, within the Vessels hanging there through the empty space, might afford heat as it were from a fire kindled within a Stove. But within all the
other

other recesses of the Brain, and besides within the folds or lappets of the Cerebel, yea and the *Interstitia* or gaps of both these, and of the oblong Marrow; this Meninx insinuates it self, and inserts the distributions of the Vessels. In truth, the protension or out-stretching of this Membrane seems therefore the more admirable, because having no where a peculiar place of its origine, it not only binds about the Head or Encephalon with a common covering, but also cloaths all its parts with proper coverings, and knits together their tops and processes. Yea this Meninx seems to enjoy a manifold and diverse original: for where-ever the gapings or *Interstitia* of any parts or processes happen, portions of this Membrane there springing forth, cover them all, and gather them together, and reach to them the ramifications or branchings of the Vessels. In a moister Brain this Meninx may be easily separated, and ample and large portions of it pulled away with the fingers; which being drawn away, the insertions of the Vessels, into the substance of the Brain and its Appendix, every where clearly appear. Lastly, by this means the brain being thus left naked; unclothed of its Membranes and Coverings, its make or fabrick, and the disposition or order of all its parts are next subjected to Anatomical Inspection.

That the Anatomy of the Brain, properly so called, might be rightly celebrated, I judge we ought not to proceed after the common way of Dissection. But whenas the substance of the whole Head, taken out of the Skull, stands in view, first let the hinder partition of the brain, where it is knit to the Cerebel and oblong Marrow or Pith, the Membranes being every where cut or pulled off, be freed (as much as it may be) from its cleaving to the subjected parts; then it will easily appear, that the substance of the brain is not united to those bodies, but of it self is altogether free and independent of them, unless where it is joyned towards the superficies by the knitting of the Membranes. Also this keel or hinder part of the brain being divided by this means from the neighbouring parts, if the fore part be bent back, the shanks of the oblong Marrow will appear wholly naked, and distinct from the brain and Cerebel (unless where they are in some places hung to it.) Moreover, when the partition of the brain, being loosened from its cohesion, is lifted up, the three Ventricles, commonly so called, go into one empty space or mere vacuity, resulting from the complication of the brain. Besides, it may be observed, how the brain before is only united to the oblong Marrow; and that in two places of its shanks, as it were the tops, it is fixed; which *Fornix* so called, or arched Vault, is as it were a string or ligament, which arising before, where the brain is hanging to it, is carried to its hinder border, to which it is united as it were with two stretched out arms, and so it holds together the whole frame of the brain, lest it be rolled out into a plain, still in a spherical figure, and firmly binds the same to the shanks of the oblong Marrow. From the knitting of the other parts of the humane brain divided and lifted upwards, whereby the vacuity resulting from its infolding, and esteemed for Ventricles, also whereby the *Fornix* or arched Vault and shanks of the oblong Marrow, naked and distinct, may be beheld, is represented by figure in the fourth Table.

And truly, this Position or Aspect of the Brain, to wit, when its hinder border or partition, being freed from its cohesion by the Membranes to the oblong Marrow, and elevated, is bent forward, exposes to be seen by the eyes themselves, its whole frame or substance, to wit, whatever it hath without or within, or before and behind, and also plainly detects what its habitude and respect is to the other parts. The chief things of these I shall add, and in the same order wherein they occurred to Inspection.

The figure of the Brain, especially in a man, shews somewhat globous or spherical: the outward superficies is on all sides noted with chinks turning and winding like to the rollings about of the Intestines: each breach or involution, yea the whole circuit of it contains a twofold substance, *viz.* the Cortical or rindy, which is the outmost and of an Ash-colour; and the medullary or marrowy, which lyes under it, and appears white. The brain being as it were plowed with these kind of rollings about, like so many ridges and furrows, is cleft in the middle, and parted as it were into two Hemispheres; yet both the moities come together, and are as it were founded in one like white substance, which covers inwardly, and as it were in Chambers or Vaults, the whole bulk of the brain. This is harder than any other portion of the brain, and as it is altogether medullary, it receives all the marrows of the circumvolutions within it self, and is to them instead of a common basis. In either Hemisphere of the brain, about the fore parts, this callous body or marrowy substance, becomes
more

more firm and thick by far than in any other place; and there it is on both sides fastned to the tops of the oblong Marrow. From those tops, as it were its beginning, this medullary substance, covering over or chambering or arching the brain, is stretched out towards the hinder parts, and by degrees lessens in its thickness: at length the outward border of this stretched out, is drawn together more narrowly, and more below, it is conjoyned by the knitting of the Membranes and Vessels (as we but now mentioned) to the tail of the oblong Marrow. Besides, for its more firm connexion, a medullary process arises from the fore part of the callous body towards the tops of it, which stretching under the fissure or cleft of the brain, reaches to its border; to which it is united, as it were with arms bending on either side: which arms indeed embrace the tail of the oblong Marrow, and so more firmly knit to it that border of the brain.

This medullary process, commonly called the *Fornix*, under its rise or beginning, hath two white and medullary roots, either of them alike going out from the callous body, which roots nigh the tops, where the brain is hung to them, meeting together, pass into the *Fornix* or Vault it self, as if it were a broad process, which stretches under the chamber of the brain, like a beam. Under this twofold root of the *Fornix* is laid cross-wise, of the same magnitude, a medullary trunk, by which, like a bridge, there is a certain passage and communication between two processes of the form of a Lentil, and chamfer'd or furrowed bodies beaming or shining in them. Further, from the midst of the superficies of this *Fornix*, a thin and pellucid hedge or pale is erected, which is affixed to the chanel or furrow of the callous body, almost along its whole passage. And for this reason, whilst the three-sided *Fornix* stretched underneath a chamber, arising from the complication of the brain, it distinguished its appearing cavity as it were into three partitions, and so caused, that in it three Ventricles were represented.

The interior recesses of the Brain will lye yet more clearly open, if the border, being on every side separated and lifted up, as much as may be, from its cohering with the oblong Marrow, be cut a little further through the substance at the sides of the same Marrow, to which it is united, nigh the chamfer'd bodies, and also the *Fornix*, being cut nigh the roots, be bent back, together with the brain; for then the frame of the brain may be wholly lifted up, turned forward, and unfolded into a plain, so that the whole interior superficies of the callous body being stretched out into a broad floor, may be seen and handled. Where, besides the medullary, and its most white substance, may be observed many white parallel lines, which cut the partition of the brain in right angles, as if they were certain tracts or footsteps, in which the animal Spirits travel from one Hemisphere of the brain to the other, and return back again.

After this manner, in very many perfect four-footed Beasts, the frame or substance of the brain was wont to be turned over, the Sphere being projected into a plain, and its interior superficies to be unfolded into breadth. Also this kind of Method of Dissection may be used in a mans brain, where the same Phænomena wholly occur to Anatomical observation. The chief difference is, that the bulk of the brain of a man; for that it is very large, and also far thicker, and endued with more turnings and windings; therefore it cannot be so easily and thoroughly inverted, as that of a Calf or Sheep, and reduced into a broad plain: yet it may be so far expanded and lifted up near its border or partition, that all the interior recesses may appear in view. The third and fourth Figures shew the image of an humane brain bent back: but in the seventh Table is shewn the aspect or sight of a Sheeps brain wholly unfolded, and as it were spread plain.

In the lesser four footed Beasts, as a Mouse, an Hare, Coney; and some others, the superficies of the brain being wholly plain or even, wants the turnings and windings; however from the complication of the border, and the under stretching of the *Fornix*, there results a cavity representing Ventricles.

After that we have thoroughly viewed all things which belong to the Brain, in the order as we have said, let either Hemisphere, covered within with the callous body, by which it hangs, be divided and removed from the tops of the oblong Marrow: which indeed may be exactly done, by cutting it near to the sides of the Lentiform prominencies, which are found in the vulgar dissection of the Head, within the interior Ventricles: for those prominences are the tops or heights of the shanks of the oblong Marrow, to which the callous body is immediately fixed. When the brain

is cut after this manner, that the prominencies, which are the tops of the shanks of the oblong Marrow, may be left naked, let them be cut long-ways through the midst (to wit, in the medullary part, where they are conjoyned to the callous body) and their interior substance will appear through the whole chamfered or streaked; viz. medullary streaks or chamferings are seen to ascend and descend forward and backward; that none may doubt, but that these chamferings or streaks were made by Nature, as it were passages or chanel for the passage and return, or going to and fro of the Spirits out of the callous body into the oblong Marrow, and on the contrary. The Figure of the shanks of the oblong Marrow, divided from the Brain, with their tops, which are the chamfered bodies, is expressed in the eighth Table.

After these striated or streaked bodies, the shanks of the oblong Marrow being divided for a little space, go forward, then being united, they meet together in the same stock, made up as it were of two stems. But the stock or trunk of the oblong Marrow in its whole tract, viz. before and after the coalition of its shanks, hath many Processes, Appendices, Prominences, and Insertions of Vessels, some of which arise from one side, and others from the other side, and make it unequal, with various productions and protuberances; of which hereafter.

The First Figure

S *Hews the Basis of an humane Brain taken out of the Skull, with the Roots of the Vessels cut off.*

AAAA. *The anterior and posterior Lobes of the Brain quadripartite or divided into four parts.*

BB. *The Cerebel or little Brain in the hinder part of the Head.*

CC. *The long Marrow or Pith.*

DD. *The smelling Nerves or the first pair.*

EE. *The Optick or seeing Nerves the second pair.*

FF. *The moving Nerves of the Eyes the third pair.*

GG. *The pathetick Nerves of the Eyes or the fourth pair.*

HH. *The fifth pair of Nerves.*

II. *The sixth pair of Nerves.*

KKKK. *The auditory or hearing Nerves and their two processes on either side of them the seventh pair.*

LLLL. *The wandring pair, or the eighth pair consisting of many Fibres.*

MM. *The Spinal Nerves coming from afar to the origine of the wandring pair.*

NN. *The ninth pair consisting also of many Fibres (which tending downwards, grow together into one Trunk) which arises a little above the process of the hinder part of the Head.*

OO. *The tenth pair tending downwards.*

PP. *The Trunk of the Carotidick Artery cut off where it is divided into the anterior and posterior Branch.*

QQ. *A Branch of it going in between two Lobes of the Brain.*

R. *The anterior Branches of the Carotides go away united, moving forward into the fissure or cleft of the Brain.*

S. *The posterior Branches of the Carotides united, and meeting with the Vertebral Trunk.*

TTT. *The Vertebral Arteries and their three Branches ascending.*

V. *The Branches of the Vertebrae growing together into one Trunk.*

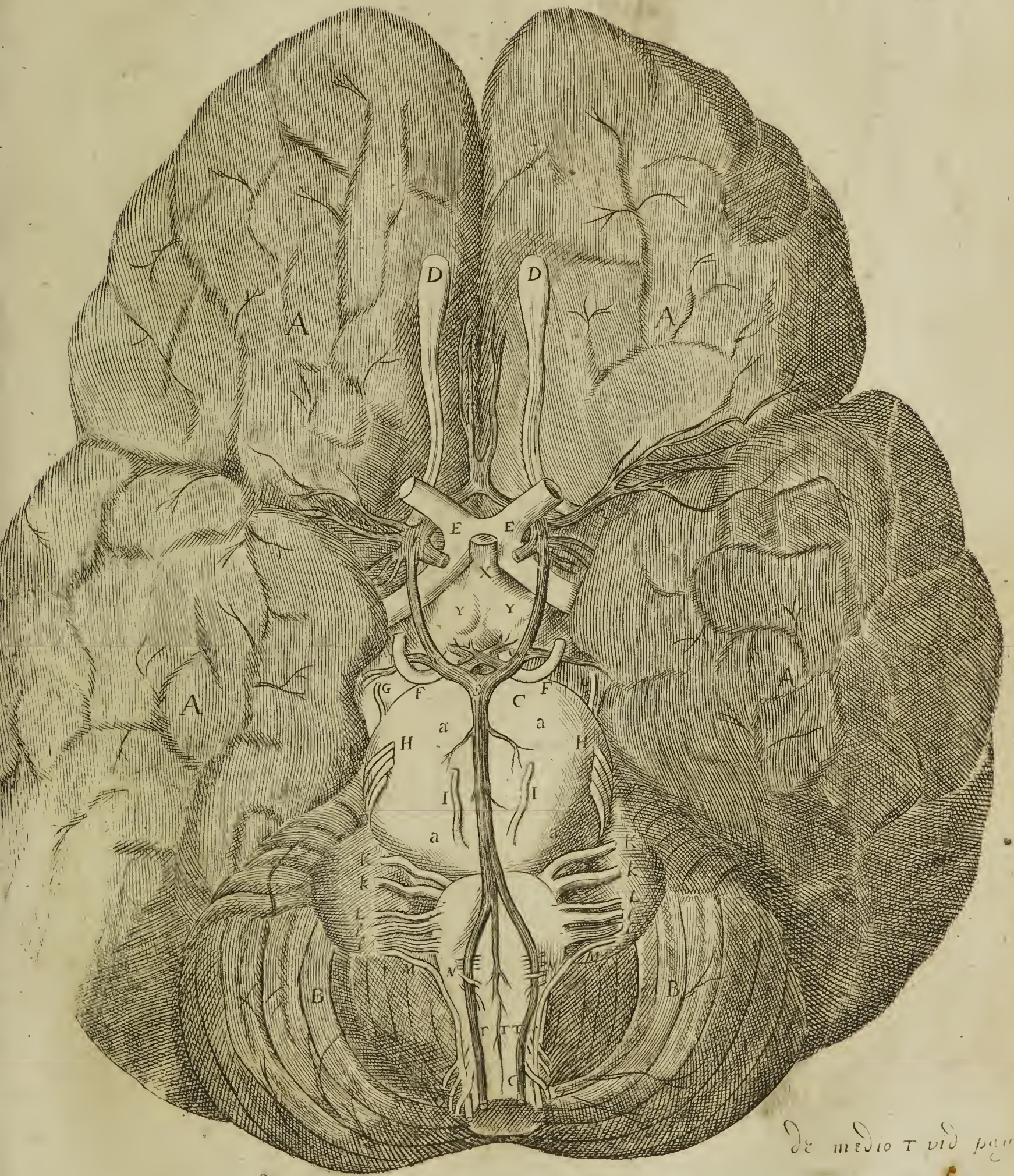
WW. *The place designed where the Vertebrae and the Carotides are united, and either Branch ascends to the Choroidal infolding.*

X. *The Tunnel.*

YY. *Two Glandula's or Kernels placed behind the Tunnel.*

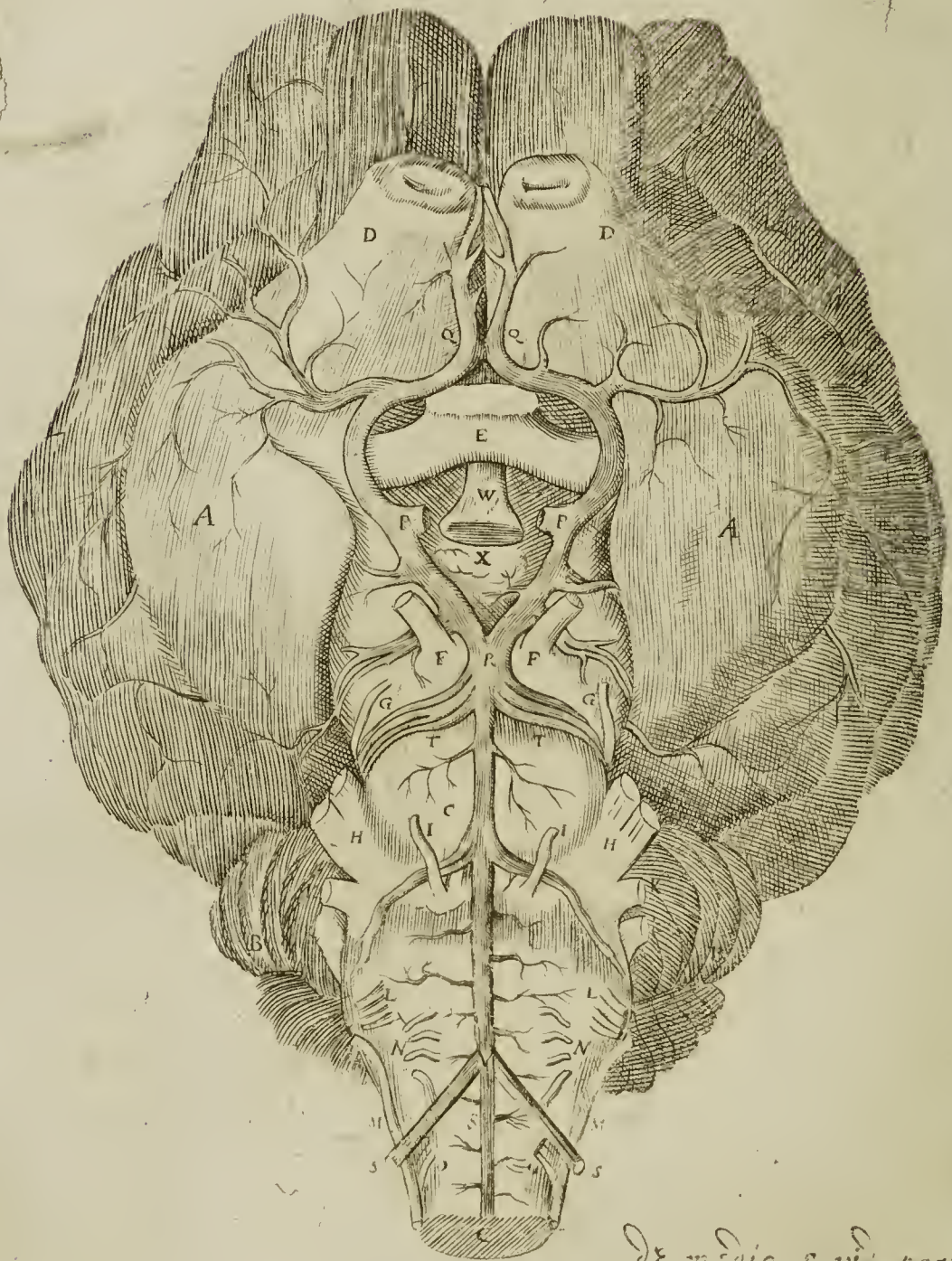
aaaa. *The annular Protuberance, which being sent from the Cerebel, embraces the stock of the long Marrow.*

Figura 1^a.



De medio T videtur





The Second Figure

Shews the Basis of a Sheeps Brain taken out of the Skull, and the Roots of the Vessels cut off, where all the Arteries, by Ink being injected into one of the Carotides, are made black and more conspicuous.

AA. Two Hemispheres of the Brain without Lobes, different from that in a Man.

BB. The lateral portions of the Cerebel.

CCC. The oblong Marrow.

DD. The olfactory or smelling Nerves cut off nigh to the mammillary Processes, that their Cavities may appear.

E. The coalition or joyning together of the Optick Nerves.

FF. The motory Nerves of the Eyes, or the third pair.

GG. The Pathetick Nerves, or fourth pair.

HH. The fifth pair: the Trunk of which Nerve is presently divided into two Branches.

II. The sixth pair.

KK. kk. The seventh pair, or the hearing Nerves, on either side of which are two Processes.

LL. The eighth or wandring pair, the origine of which is made up of very many Fibres seeming to grow together.

MM. A Nerve coming out of the spinal Marrow to the beginning of the wandring pair.

NN. The ninth pair, consisting also of divers Fibres arising distinctly, which afterwards grow together into one Trunk.

OO. The tenth pair tending downwards.

PP. The Trunk of the Carotidick Artery cut off, where it is divided into the anterior and posterior Branch.

QQ. The inosculation of the anterior Branches.

R. The posterior Branches of the Carotides united, and meeting with the Vertebral Trunk.

SSS. The Vertebral Artery ascending with a triple Branch.

TT. Where the Carotides meet the Vertebral, and on either side many Arteries ascend to the Choroeidan infolding.

V. The coalition or joyning together of the Vertebral Branches into the same Trunk.

W. The Tunnel.

X. A white Glandula or Kernel placed behind it.

C H A P. II.

The Parts of the oblong Marrow, and the rest of the hinder Parts of the Head are recounted, and their Dissection shewn.

HAVING described both the Meninges, and the ramifications of the Vessels in them, also the fabrick of the Brain, properly so called; and next shewed its outward partition gathered together into folds about the shanks of the oblong Marrow, and either middle or marrowy part of it hung to the chamfered bodies; we will now follow the remaining parts of the Head in order.

The chamfered or streaked bodies, or the tops of the oblong Marrow, are two lentiform Prominences, which are beheld within the former Ventricles of the Brain, as they are commonly termed; the heads of these, which are more large and blunt, incline mutually one to another, and are almost contiguous. Out of the angle of this inclination the *Fornix* arises with a double root; to which is subjected or underlaid a certain transverse medullary process, and seems to knit together these streaked bodies, as may be seen in the seventh Table GG: but the ends of those bodies, being made sharper, are reflected outward, and make as it were two sides, with a sharp triangle, to whose anterior superficies the marrow of the callous body sticks for a long tract; where, if these bodies be cut long-ways through the midst, the medullary streaks (as was already said) will presently appear. The figure and place of these, as also the medullary chamferings, are truly represented in the eighth Table.

Where the streaked bodies end, the chambers or *Thalami*, as they are termed, of the optick Nerves, possess the next part to the oblong marrow; to wit, in this place,

its shanks rise into unequal protuberances, out of the ridges of which the Optick Nerves arise, and from thence, being bent down in the fore-part with a certain compass, they joyn together about the base of the same marrow, and seem to be united; by and by being again parted, and going forward towards the ball of the Eye, they go out of the Skull. In this place the shanks of the oblong marrow in a Man are for the most part distinct, and gaping one from another, leave a descending opening, which is the passage to the Tunnel; but in most four-footed Beasts the shanks of the same medullary stocks are there distinct, only a little lower, and have a chink cut for the Tunnel: but the ridges of them, in which the beginnings of the Optick Nerves lye hid, are somewhat conjoyned, and for the space of half an inch do grow together. Wherefore in Brutes there is one hole before this growing together, and another behind it, both which lead towards the Tunnel. The reason of this difference is, because in a Man, for that the frame or substance of the brain it self is very large, and that its marrowy parts are remote one from another, it is behoveful for its shanks, whereby the tops of the oblong marrow may be the better fitted to the same, to be separated, and from their mutual touching to be bent into a greater aperture. Hence it is observed, that in a Man the shanks of the oblong marrow, from the hanging on of the brain, go forward with a greater angle of inclination, and with a certain bending compass; but in Brutes the same lye almost parallel. After what manner these parts are formed in an humane brain the third and fourth Figure shews; after what manner they are in four footed Beasts is shewn in the seventh Figure.

From the same ridges of the medullary shanks, from whence the Optick Nerves take their origines, certain medullary processes arising, and being dilated on either side above the brim of the second hole, grow together about the root of the pineal Glandula. These processes (as it seems) are those parts, which the Famous *Cartes* supposes to be Nerves belonging to the pineal Glandula: but I rather suspect them to be productions only, by which the Optick Nerves may also communicate near their origines. Their figure is very well described in the seventh Table.

After the *Thalami* or Chambers of the Optick Nerves, other notable protuberances, commonly called *Nates* and *Testes*, the Buttocks and Testicles (of the brain) grow to the superior part of the medullary Trunk or stem, and cover its superficies about the space of an inch; and for that they are not contiguous in the midst, there is under them a certain hollownes in their whole tract. These protuberances are lesser in a Man, also in a Dog and Cat; lastly, if we observed rightly, in other living Creatures, which are newly brought forth, that are impotent, and not instructed for the finding out of food. In a Calf, Sheep, Hog, and the like, they appear far greater: in Fishes and Fowls they are wholly wanting.

In number they are four, viz. two grow to either side of the oblong marrow. The former called *Nates* or the Buttocks, seem the greater and principal; to which the other latter called *Testes* or the Testicles, hang as if growing out of them. As to their figure, they are round, and are commonly taken for two shanks on either side of the brain and Cerebel planted near, which being bent inwardly, and turned back one towards the other, are said to grow together, and so to constitute the oblong marrow. But this opinion, as we shall shew more largely hereafter, by the dissection ordered according to our Method, is clearly false. For it plainly appears, that the brain is fixed, long before these bodies, to the oblong marrow; nor is there any commerce between these and that, unless very remote.

But if the site of these parts, and their respects and habitudes to the neighbouring bodies, be well noted, it will appear plainly, that they make as it were a certain peculiar Region wholly distinct from the Brain and Cerebel, also from the oblong marrow it self. Their situation is remote enough from the fore-parts, and sufficiently separated by the Cavity or Ventricle under-lying from the medullary stock or stem: yea a proper way, or one process, seems to lead from the long marrow into these prominences; and another to go from them, and thence to be carried into the Cerebel. From hence we may suspect, that these prominences (especially the *Nati-form*, or of the shape of a Buttock, which are the chief) are certain places of diversion; in which the animal Spirits go apart in their passage from the oblong marrow into the Cerebel, and from this to that on the other side, and there stay for some animal uses, of which we shall speak hereafter. As to the way, which leads from the oblong marrow into these prominences; it is manifest, that beneath the origines of the Optick Nerves on either side a medullary Process descends, with little Villages proper

proper for it self, which terminates in the aforesaid prominencies. Then, if from these, you look for a passage out, it is equally clear, that from the hindermost prominences, which are called *Testes*, on either side, a medullary process doth obliquely ascend, which being dilated into the Cerebel, is divaricated through its whole frame. But that the Natiform or Buttock-formed Prominences are Principals, and the *Testes* their dependences, or the heads of medullary Processes, which are carried from thence into the Cerebel, manifestly appears in a Sheep, Calf, or Horse, and in some others, where the *Nates* are of a noted magnitude, the *Testes* of a very small bulk grow to them, and in the middle between these the medullary Processes, the Appendices of the former Prominences, exist. The aforesaid Prominences, as also the medullary Processes, which lead forward and backward, to and from them, are aptly represented in the fourth Table, but yet more clearly in the eighth Table TT. PP.

Further, because the animal Spirits residing in either Promptuary and Appendix, before they are carried to the Brain, ought to be confounded and mingled together, therefore the two prominences of either side do mutually grow together as it were with wings stretched out one to another; but for as much as it is behoveful for those growings together to be distinguished from the oblong marrow, therefore an hollowness comes between, which is by some esteemed the fourth Belly, and by others a passage to it. These prominences in a Man, Dog, and Cat, and some other Animals (as was above mentioned) are very small, and almost even; also they appear, as the other portion of the oblong marrow, of a white colour. In a Calf, Sheep, Horse, and many other four-footed Beasts, the former protuberances, commonly called *Nates* or Buttocks, are remarkably great, also outwardly they appear to be of a flesh colour, because they are cloathed with the thin Meninx or *Pia Mater*, which contains in it self very many Veins and Arteries; which if separated, the interior substance of those parts is of a wannish colour, and such as is not in all the oblong marrow or pith besides. But it plainly appears, as in Brutes, so in Man, the hinder or posterior prominences are Epiphyses or additions of the former, and that from these additions or dependences the medullary processes ascend obliquely into the Cerebel; near which, other processes cutting those, descend direct from the Cerebel, which seem not to be inserted into the medullary Trunk, but going about it, do constitute the annulary or ringy protuberance. This annulary protuberance is greater in a Man than in any other Creature. Besides, it is observed, that where-ever the superior prominence of the Buttock-form is larger, this inferior annulary is very small; and so on the contrary. Further, those medullary processes, ascending towards the Cerebel, communicate mutually among themselves by the other transverse medullary process; and out of this transverse process, two small little Nerves arise, the fourth pair of those which we have recounted, and which are called by us Pathetical. Each of these, delineated in fit figures, the seventh Table shews clear enough.

Not far from the aforesaid Prominences, to wit, between these and the Chink, which is called the *Anus* or Arse-hole, the Pineal Glandula or Kernel is placed. This is put in a Valley, which lyes between the Natiform protuberances, and those which are the Chambers or *Thalami* of the Optick Nerves; in which place that Glandula or Kernel is fixed, sometimes by very many small Fibres, and sometimes by two noted medullary roots subjected to the part; and besides, it is included in a Membrane, which is a portion of the *Pia Mater*, as in a Chest; and as this Membrane is stuffed with very many Arteries and Veins, some small Vessels also enter into this Glandula.

Under the Prominences but now described, (as was above hinted) a narrow Cavity or Ventricle is stretched out with a long passage, which, although it obtains some egregious uses, yet it self seems to be only secondary, and as it were by chance; for that the processes of either prominence ought to be conjoyned among themselves, and to be distinguished from the under-lying medullary Trunk. Two holes lye open into this Trunk, one of which is placed in the beginning, and the other in the end of it, and through the middle of its passage the down-bending aperture tends towards the Tunnel; so that the ferous humor entring at either hole, may presently slide away into the Tunnel. Moreover, into the same aperture of the Tunnel there lyes open another passage, to wit, through the first hole, which is placed near the roots of the *Fornix*; so that from every quarter of the Head the ferosities might be carried into that sink: to wit, that through the first hole, from the infoldings or the anterior Ventricles of the Brain; through the second hole, the humors which are gathered about the orbicular prominences, do come away; and through the third hole, those

which are laid up nigh the confines of the Cerebel, do find a passage. These several holes, with the distinct ways to the Tunnel, are plainly delineated in the seventh Table H. M. T.

Above the Pineal Kernel, as it were above the Button, the infolding of the Choroides seems to be hung; now this infolding is made after this manner: out of either side of the oblong marrow, where the border of the brain is knit to it, two Arteries arising from the posterior branches of the Carotides, where they are united to the Vertebrae, do directly ascend; which being presently divided, like many Rivers planted near together, are carried towards the pineal Glandula, and there seem to be terminated by a mutual meeting: and in that place, out of the fourth bosom, sent down upon the pineal Glandula, the veinous branches come out on both sides, which in like manner being divided into filaments or small threads, meet with the capillary or hairy Arteries, and are in many places inoculated into them, and variously complicated with them; and so these Vessels, being Net-like, much interwoven among themselves, and interserted with the Glandula's, do constitute the to be admired infoldings. These kind of infoldings of the Vessels, as it were with two out-stretched wings, are thrust out on either side upon the shanks of the oblong marrow, even to the streaked bodies; but yet they only lye upon their superficies, nor are they more firmly affixed either to the oblong marrow, or to the callous body by any insertions of the Vessels; so that the blood seems only to be brought to these places, and carried away without any afflux of it made into the subjected parts; for what uses shall be spoken of hereafter. The Choroidal infoldings, with the pineal Glandula, are drawn out in the seventh Table G. F. E.

And thus far concerning the appearances found above the oblong Marrow, between the streaked bodies and the Cerebel; which indeed are almost constantly after a like manner both in Man and four-footed Beasts, unless that they only differ in bigness. Within this space, in the Pedestal or Basis of the same Marrow, many things worth noting occur: For besides the ends of the cut off Vessels, which are above recited, the site and structure of the Infundible or Tunnel deserve consideration. For behind the coalition or joyning together of either Optick Nerve between the shanks of the oblong marrow there gaping, is sent down a receptacle as it were tubulated or made like a Pipe, covered without with a thin Membrane arising from the *Pia Mater*, and defended within with a medullary substance. The orifice of this is placed higher between the shanks of the oblong marrow, and receives their bending aperture; from thence a short Tube or Pipe being sent down, is inserted to the pituitary Glandula or Kernel. We see this Tube in an Horses brain greater than a Gooses quill, also shining and full of clear water; that it is not to be doubted, but that by this way the ferous humors slide away from the brain to the pituitary Glandula: but how these humors are carried away from thence, shall be afterwards inquired into, because they are not carried into the Palate or roof of the mouth, as is commonly believed.

Nigh the lower border of the Tunnel, in a Man, underneath there are two whitish Glandula's; though in Brutes only one, but greater, is found. What is the proper use of this part shall be told hereafter: in the mean time, whether it be doubled or only one larger, it seems to be as it were instead of a bank to defend or preserve the thin Membrane of the Tunnel, lest it should be broken or thrust out of its place: on the other side the growing together of the Optick Nerves serves instead of the same kind of defence.

What besides is contained in this space are only the shanks of the oblong marrow itself, which proceed directly from the chambers of the Optick Nerves towards the hinder part of the Head in a straight passage; and when both grow together below the Tunnel, they are afterwards distinguished in their whole tract by a line drawn through the midst. These shanks of a mans brain are far larger than in brute beasts: to wit, in that they seem to be made up of very many medullary chords or strings joyned together in one, as if in this common passage and high-way of the animal Spirits, they were so many distinct paths, which the Spirits enter into respectively, according to the various impulses of sense and local motion. Moreover, this space of the oblong marrow therefore appears shorter and more broken in a man, because much of it is hid by the annular protuberance, which is sent from the Cerebel, and is very big. The *Pia Mater*, all about covering the sides of this medullary Trunk, cloaths them with most thick infoldings of the Vessels; by which heat and the nervous juyce are carried, as a continual provision for the Spirits, taking a long journey. Thus much for

for the first Section, or anterior portion of the oblong marrow: now our order carries us to the inspection of its hinder Region, to wit, where the Cerebel grows to it; and the Processes sent from this either compass about its Trunk, or are inserted into it; out of which also, the other Nerves produced within the Skull, take their beginnings. Concerning these we will speak in order.

C H A P. III.

A Description of the Cerebel and its Processes, also of the hinder Region of the oblong Marrow.

Below the orbicular Prominences, the Cerebel follows to be inspected. The figure of this, like the Brain, is somewhat globous, also it appears unequal, marked with certain turnings and windings about; the ridges and furrows of whose turnings about the *Pia Mater* stretches over, and reaches out the infoldings of the Vessels to them all, and deeply inserts them into all. However the Cerebel is diversified or variegated with its turnings and rollings about, not as the Brain, after an uncertain manner; but its folds are disposed in a certain orderly series; for the exterior frame of it seems to consist of thin lappets, or little rings or circles, being contiguous and infolded, also going about through the whole compass with a parallel site or situation.

Either Region of the Cerebel, to wit, the former and the hinder, is terminated in a process in form of a Worm. According to these ends, as it were in a double Pole, these Circles are very short; thence ascending towards the top or Equator, they are by degrees enlarged, as it were Parallels in a Sphere or Globe. These Circles are outwardly Cortical or barky, and within medullary, and all their marrowy parts pass into two ample middles; which indeed seem to be the same in the Cerebel, as the callous body in the brain.

The Cerebel in some Animals consists of one frame, and all its little circles are placed in the same parallel site, and keep the same proportion among themselves; but in others there grow to the Cerebel as it were the primary Sphere, and endued with greater circles, some other bodies as it were Wens or Extuberances, or additional Spheres marked with lesser circles. These being eccentric to the Cerebel it self, have oftentimes labels or folds ordered in a diverse series from it.

But the Cerebel it self (whether it hath these little Excrescences growing to it or not) is found almost in all Animals of the same figure and proportion, also made up of the same kind of labels or lappets. Those which have the brain diversly framed from a Mans, as Fowl and Fishes, also among four-legged Creatures, Conies and Mice, whose brains want turnings about or convolutions, have the like species and the like disposition of the folds and composure of the other parts of the Cerebel. The reason of this difference in the brain, and of the conformity in the Cerebel, is rendred hereafter, when we treat of the Use of the Parts.

As the Brain, within its Cavity, hath the Choroidal infolding made up of Arteries and Veins variously complicated, and of Glandula's thickly interserted; so also the Cerebel hath got the like infoldings of Vessels, and those marked with very many Glandula's, and greater than those in the Choroidal infolding. These infoldings and heap of Kernels, the *Pia Mater* being separated, which clothes the hinder part of the Cerebel, easily appear in sight; for in that place these creep upwards on either side nigh the Worm-shaped process, as it were with two branches; and receive the Artery on either side, from the Vertebral Artery, lying under the Basis of the oblong marrow and the veinous passages, sent from either lateral bosom. We shall inquire hereafter into the use of this Infolding and of its Glandula's.

In the mean time, that we may describe the site and hanging on of the Cerebel; the same standing on the oblong marrow seems to be fixed to its sides, as it were by two little feet; between which, planted on either side, and the Cerebel placed above, and the trunk of the long marrow below, (because all these should be distinct one from the other) there comes a cavity or hollowness between, which is commonly called the four Bellies.

In either little foot, sustaining the Brain, are found three distinct medullary Processes. The first of these, sent from the orbicular Protuberances, ascends obliquely; the second descending straight from the Cerebel, and passing through the other across, compasses about the oblong marrow; the third process, descending from the hinder Region of the Cerebel, is inserted into the oblong marrow, and increases its trunk as it were with an additional cord or string. These several Processes are truly represented in the seventh Table Q. P. R.

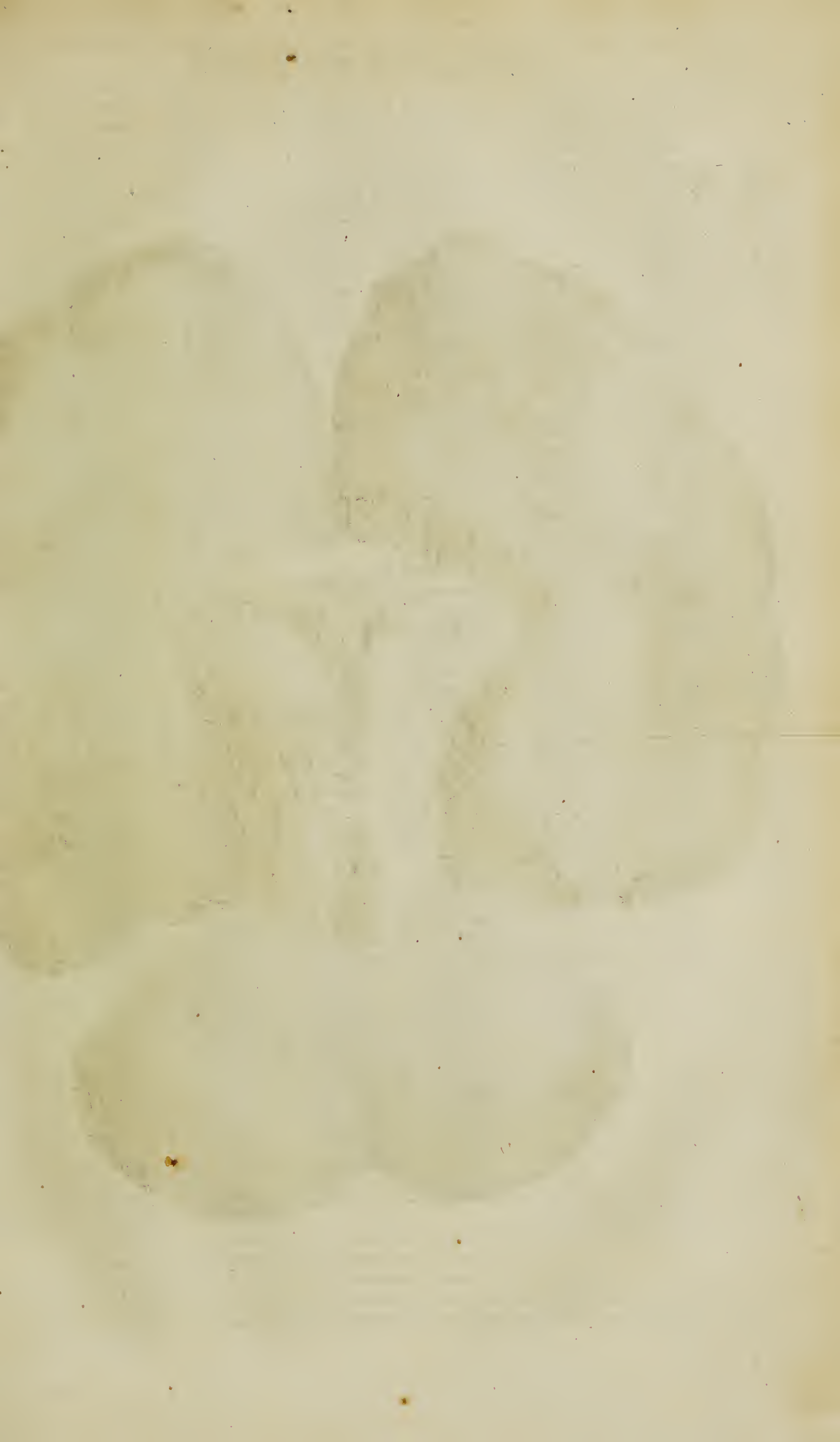
But as to what belongs to the annular or ringy Protuberance, by which the medullary Trunk, both in Man, and in some four-footed Beasts, is compassed about, that is made after this manner. The second or middle process of the Cerebel, descending straight to the oblong marrow, seems not to be implanted in it, as soon as it touches its sides, but growing into a larger bulk, goes about the superficies of the same marrow with divers circular Fibres. And so when in either side both those kind of processes of the Cerebel, being dilated or carried from the top of the medullary Trunk toward its Basis, do mutually meet, they make that circular protuberance. The substance of this is far larger in a Man than in any other Animal; in an Hare, Rabbit, Mouse, and the like, it is very small; in Fowl it is either wholly wanting, or for its smallness scarce to be discerned by the eyes. Concerning its bulk, this is a constant observation. They who have the orbicular prominences before the Cerebel small, have this annular protuberance very big; and on the contrary, they who have those prominences big or very great, have this ring very small: further, they who wholly want the Buttock-form protuberances, as in Fowl, seem also to want this annular.

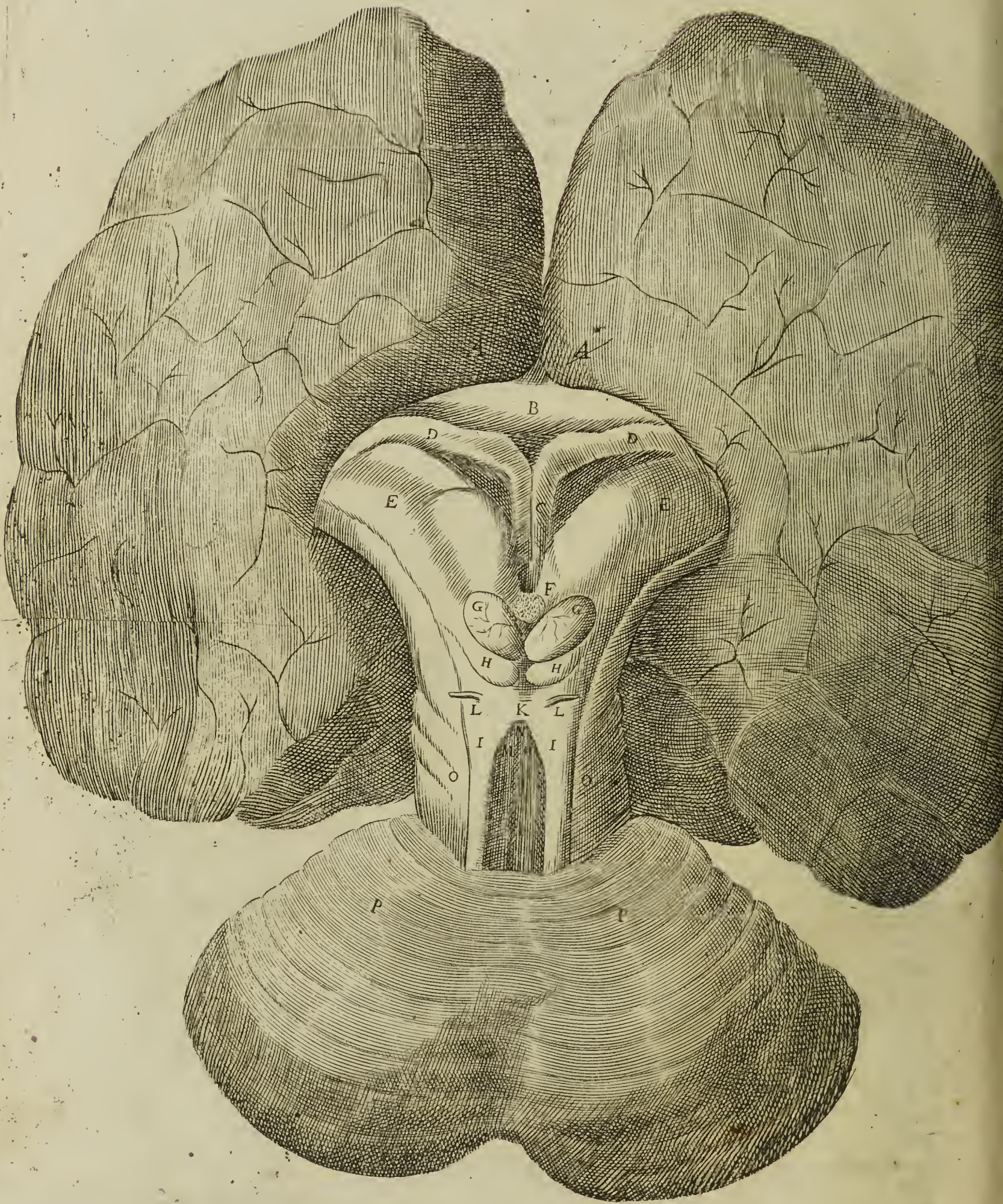
In many brute Animals, but not in Man, nigh to this greater Protuberance, a little lower, another lesser, in like manner orbicular, stands, and compasseth about the superficies of the oblong marrow; the root of which is a white and medullary line, stretched out under the Cerebel, above the bottom of the fourth Ventricle. From the sides of this lesser protuberance the auditory Nerves arise: In Man the auditory or hearing Nerves are seen to arise out of the utmost brim of the greater protuberance, in like manner they have for their root a white medullary line covering the fourth Ventricle.

That this line, and the three distinct medullary Processes, which constitute either little foot of the Cerebel, may be more plainly shewn, also that the most inward frame of the Cerebel may be viewed, its whole globe ought to be cut through both Poles, *viz.* in the middle through the Vermiform or Worm-shaped processes; then it will plainly appear, that in either Hemisphere there is an ample middle or marrow, wherein the marrowy branches, being stretched abroad on every side, like those of a tree, spread through the Cortical substance of the Cerebel, every where diffused; and that in either middle or marrowy part, the three distinct processes, which make either trunk, or little foot of the Cerebel, are inserted. Each of these are fitly represented in the seventh Table.

Thus much for the Cerebel, and by what means it is fastned to the oblong marrow. Beside these, it is to be observed, that about the bottom of the Basis of the oblong marrow, out of the greater Ring, come out two medullary strings, which being distinct from the rest of the medullary Trunk, go right forward towards the spinal marrow, and in its progress, being made straiter by degrees, like Pyramids, after about the space of an inch, end in sharp points. The extremities of these consist on the other side, where the wandring pair of Nerves have their original, and make a certain rising up in the oblong marrow. Hence it is likely, that these strings are passages or channels of the animal Spirits, wherein they are carried from the greater Ring, or what is the same thing, from the Cerebel into the wandring pair, and the beginnings of other Nerves implanted near; for what end, shall be said hereafter. These pyramidal Bodies do not so manifestly appear so long as the *Pia Mater* clothes them, and hides them with the infoldings of the Vessels; but this Membrane being pulled away, they are so conspicuous, especially in a Man and a Dog, that they seem like greater Nerves. In those Animals, where the annular Protuberance is greater, these processes being brought from the same in right angles, are greater and more conspicuous; and on the contrary, in Fowl they are clearly wanting.

Concerning this hinder Region of the Head, there is not much besides worth noting, except the productions of the Vessels. But there are Vessels which chiefly belong to these parts, the latter six pair of Nerves arising within the Skull and the Vertebral





tebral Arteries. We have already described in some measure the beginnings of the former; what belongs to the more full knowledge of them, we shall leave to be handled in its proper place. As to the Vertebral Arteries, they reach from about the farthest end of the oblong marrow, now about to end in the spinal, to its sides. These Vessels, as they are smaller, so they enter the Skull with lesser provision than the Carotides; for they are neither flourished first with Net-like infoldings, nor are carried in a long journey by compassing about; but either Artery, passing directly through the Cuniform or Wedge-like Bone, embraces the medullary Trunk on either side. Although these go forward divided for a little space, yet afterwards they are united, and with a single chanel or passage, they meet with the posterior Carotides inclining mutually one towards the other; and so all the branches, meeting as it were in a threefold way, are inoculated one in another. The Vertebral Arteries, first shewing themselves within the Skull, are disposed otherwise in Brutes than in men: in the latter they fall through the sides of the oblong marrow parallel for some space, then as it were with a certain semicircular compass, they mutually incline one towards the other, and presently meet. The branches which first go forwards divided, are sometimes only two, to wit, one on either side, sometimes three, and then besides the two former, another is produced in the middle. But in Brutes, either Trunk of the Vertebral Artery, at the first coming to the marrow, inclines presently to the meeting of the other with an acute angle, and quickly both meet together. The *Vertebrals*, even as the *Carotides*, send forth manifold branches in their progress with an innumerable series of shoots, which cover over the oblong marrow, the Cerebel, and all their cavities and recesses, and water them all with a plentiful flood of blood.

These are the Phænomena or Appearances which the whole frame of the Brain and its Appendix is wont to exhibit to Anatomical Inspection, and which, as to its fabric, and all its parts, and processes, are to be found both within and without. As it is a hard and troublesom business to inquire into the actions and use of each of these, so it is also joyned with so much pleasure and profit, that I dare promise to my self and others, that it will be a thing worth our labour and while. Yet before we enter upon this, there remain to be unfolded some things hid in some of the bones of the Skull, such as are the pituitary Kernels, the admirable Net, and some others; also we ought to shew first, briefly at least, a type or figure of the Brains in Fowl and Fishes.

The Third Figure

Shews the outmost or superior Superficies of the humane Brain taken out of the Skull; where the border of the Brain being loosned from the knitting of the other Parts, made by the Membranes, is elevated and turned outward, that the shanks of the oblong Marrow, the Fornix or arched Vault, the Nates and Testes, with the pineal Kernel, and other Processes, may be clearly and distinctly beheld.

- AA. The border of the Brain, which in its natural situation was contiguous to the Cerebel.
- B. The brim or margent of the callous Body besmearing either Hemisphere of the Brain, which in its natural site leans upon the pineal Glandula.
- C. The Fornix or arched Chamber.
- DD. The Arms of it embracing the shanks of the oblong Marrow.
- EE. The shanks of the oblong Marrow, out of which the Optick Nerves proceed, and the tops of which (situated further out of sight) are the streaked Bodies.
- F. The pineal Glandula, between which and the root of the Fornix, stands the chink leading to the Tunnel.
- GG. The orbicular Protuberances which are called Nates or the Buttocks.
- HH. The lesser Protuberances called Testes or the Testicles, which are Excrescences of the former.
- II. The medullary Processes which ascend obliquely from the Testes into the Cerebel, and constitute part of either of its Meditullium or marrowy part of it.
- K. The meeting of those Processes through another transverse or cross Process.
- LL. The beginning of the pathetick Nerves out of the meeting of the aforesaid Processes.
- MM. A portion of the oblong Marrow lying under the aforesaid Processes and Protuberances.
- N. The

- N. The hole of the Ventricle or Cavity which is placed under the orbicular Protuberances.
 OO. A portion of the annular Protuberance sent from the Cerebel, and embracing the oblong Marrow.
 PP. The outmost and upper superficies of the Cerebel.

The Fourth Figure.

The Effigies of an humane Brain of a certain Youth that was foolish from his birth, and of that sort which are commonly termed Changelings; the bulk of whose Brain, as it was thinner and lesser than is usual, its border could be farther lifted up and turned back, that all the more interior parts might be more deeply beheld together.

- AA. The border of the Brain lifted up, and very much bent back, which in its natural site, being knit to the oblong Marrow, nigh the Cerebel, did hide the Nates and Testes.
 B. The border or inferior margent of the callous Body.
 CC. The Fornix, with its two Arms, embracing the shanks of the oblong Marrow.
 DD. The internal cavity or hollowneß of the Brain resulting from the folding together of its border about the oblong Marrow.
 EE. The tops of the shanks of the oblong Marrow, or the streaked or chamfered Bodies.
 FF. The Chambers of the Optick Nerves.
 G. The pineal Kernel, between which and the root of the Fornix the hole is, whose passage leads both to the Tunnel, and to the Ventricle lying under the orbicular Protuberances.
 HH. The Protuberances called Nates.
 II. The Protuberances called Testes.
 KK. The medullary Processes stretching out from the Testes to the middle of the Cerebel.
 LL. The laid aside Hemispheres of the Cerebel cut in two through the midst, that the Trunk of the oblong Marrow may be the better seen, where its medullary substance branches out into the form of a tree.
 M. The Furrow below the medullary stock, which being covered by the Cerebel, makes the fourth Ventricle in the form of a writing pen.
 NN. The medullary Processes which seem to be passages out of the oblong Marrow into the orbicular Protuberances.
 O. The end of the oblong Marrow giving place to the spinal.

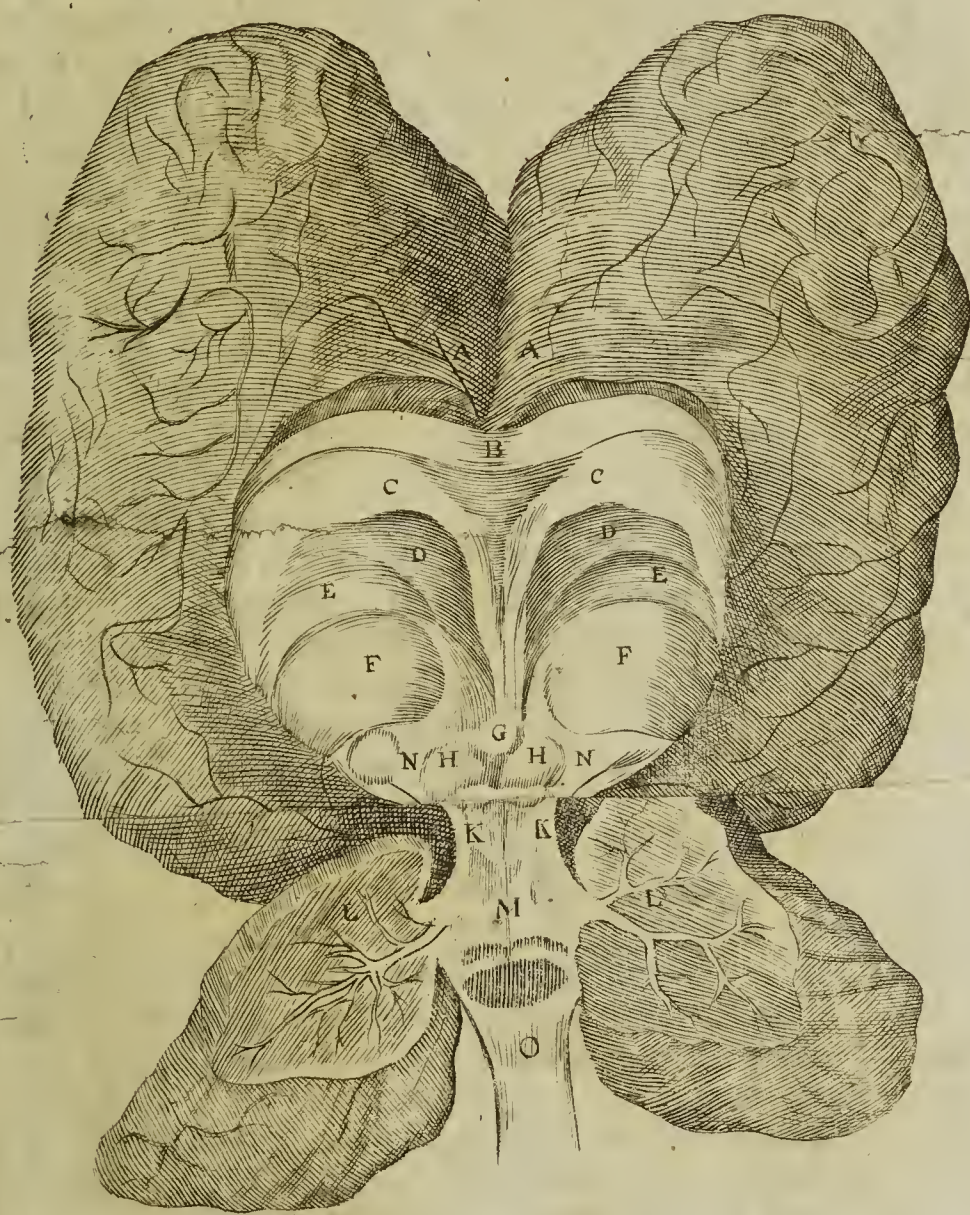
CHAP. IV.

The Parts and some of the Contents of the separated Skull unfolded.

IT is not our intent, nor will it be needful for us to delineate the figures and situation of the several Bones of the Brain-pan, or to describe their various holes, which transmit the Trunks of the Vessels like the hanging weights of a Clock. All these are well enough known; so that to treat of these Gates or Entries is superfluous. Besides also, by what means the Nerves, arising within the Skull with their ramification or branching forth, enter the dens and caverns of the Bones, shall be delivered particularly afterwards. Wherefore for the present our business shall be only to take notice of some things, chiefly worth noting, concerning the sanguiferous Vessels passing through the Cuniform or Wedge-like Bone, not sufficiently noted by others.

Among the various uses and offices which the Cuniform or Wedge-like Bone yields to the Brain and its Appendix, it is not of the least note or moment, that it transmits the Carotidick Arteries, not without a certain mechanical or artificial provision; and that in the middle way, by which they must pass, it contains the pituitary Kernel, and sometimes the wonderful Net. Each of these deserve consideration; the more, for that in divers Animals they are after a different manner; and because it is much controverted among Physicians concerning their frame and use. But we will first speak of the pituitary Glandula, because this part, being placed higher, is observable to Anatomical Inspection before others.

The pituitary Glandula or snotty Kernel is hid within a proper Cell or stall, made hollow in the middle of the Wedge-like Bone, being shut up in the Chest sometimes more







more strictly, sometimes more loosely: For in a Dog, Cat, and some other Creatures, sticking to the Tunnel, it is pulled away together with it when it is removed; and then its bulk consists of two Glandula's or Kernels distinct among themselves; and easily to be separated one from another. But in a Calf, Sheep, Hog, and many others, it is strictly included on every side, except where it admits the Tunnel, and clothed with the hard Meninx or *dura Mater*, and with its coverings shut up between the cavity of the bone. Besides, in these, its frame or substance seems but one and undivided; though, in truth, it is made up of a substance which is of a twofold nature or kind.

This Glandula is found in all perfect Creatures; for Man, all four-footed Beasts, yea Fowl and Fishes are provided or endued with it: from whence we may conclude it to have some necessary uses in the Brain. But as to its quantity or bigness, its proportion is various in divers Animals, according to the bigness of the head and body wherein it is; because in a Lamb it is greater than in a Man or a Dog; also its bulk in a Horse is lesser than in an Ox. But the reason of this difference seems to consist in this chiefly, for that the pituitary Glandula in some, respects the bulk of the brain only laid upon it, and in others both the brain and the Carotidick Arteries ascending near it; and so as it hath a respect to both these together, or only to one, its substance or bulk is either greater or lesser. For truly in some Animals the Carotidick Arteries being dilated within the Skull, are presently divaricated into Net-like infoldings, and from those infoldings many shoots of the Vessels every where enter this Glandula, and are interwoven into its substance. Further, because this infolding of the Vessels, called the wonderful Net, is found very large in some, and in others very small; therefore this Kernel, for as much as it admits from these, few branches; and from those far more, and in some other Animals scarce any shoots from the Arteries, answers to this divers distributions of the Vessels, with the various proportion of its bulk. Because it is observed in some Animals, as chiefly in a Man and a Horse, that this wonderful Net is wholly wanting; and whereas in such, either Artery is carried about by a long compass between the recesses of this bone; from its trunk in a man sometimes one or two shoots, sometimes none, are carried into the pituitary Kernel; also in an Horse fewre branches enter into it, and so its bulk in these becomes lesser.

But in very many other Animals (especially those who have the wonderful Net) it may be proved, besides ocular inspection, also by this Experiment, that many sanguiferous Vessels enter this Glandula: for if an inky liquor be squirted into the Carotides with a Syringe, the exterior part of the Glandula, that is interwoven with the blood-carrying Vessels, will be very much dyed with a black colour. Wherefore without doubt, it may be thought, that this Glandula doth receive into it self the humors, to wit, flowing into it from the Tunnel in all kind of living Creatures, and in some from the branches of the Carotides. Yet by which way these humors are carried away again, doth not so plainly appear; for we affirm, with the most Learned *Schneider*, that they do not at all fall down into the Palate through the holes of the under-lying bone. Yet in the mean time, we suppose those holes to be only made to procure lightness to the bone; because in those Animals, which have the greater pituitary Kernel, those holes in the bone are more and larger: further, I have often found vessels or chanel's to be contained between those holes: and when I had injected Ink within the great hole of the same bone in a Calf, the black liquor presently entred the lesser Vessels subject to the bone, and at last the Jugular Vein. And by this Experiment chiefly we conjecture concerning the office and duty of this Glandula; of which we shall speak more fully hereafter, when we inquire into the use of this and the Tunnel.

Nigh to either side of the pituitary Kernel, if the *dura Mater* be opened, the Carotidick Artery lyes stretched out upon the wedge-like bone, about the length of an inch: for as this Artery rises up below the Turkey Chair, sometimes higher, sometimes farther within the Skull; the same being presently bent in from its first ascent, goes in under the *dura Mater* till it comes to the anterior border of the same Chair; where again being intorted, and being sent forth upwards with a certain compass, it perforates the hard Meninx, and is carried straight towards the Brain. So this Vessel with its double ascent and crookedness (to wit, above the Basis of the Skull, and then above the hard Meninx, together with its situation, stretcht out in length under the same) represents in most the letter  inversed; but in a man (as shall hereafter be more largely shewn) its site, by reason of the longer tract of the Vessel and its greater curvature, represents the same letter double after this manner .

The Carotidick Artery in all Animals ascends obliquely within the Skull; but as to its site or protension nigh the pituitary Glandula, it is not after the same manner in all: for in a man passing through the Canal-bone, peculiarly ingraven by it, with a single Trunk, it lyes every where stretched out at length; and out of this Trunk it sends forth sometimes, though not always, some shoots to the pituitary Glandula. Also in a Horse, its Trunk is single; but where it first arises within the Skull, either Carotides, through the cross branches sent from one side to the other, before they perforate the *dura Mater*, communicate among themselves. And as in most other living Creatures, the Artery, however before branched forth, yet being made one single Trunk, goes into the Brain; in a Horse either Carotick Artery being parted in two, sends forth upwards two branches, arising from the *dura Mater*, in two distinct places.

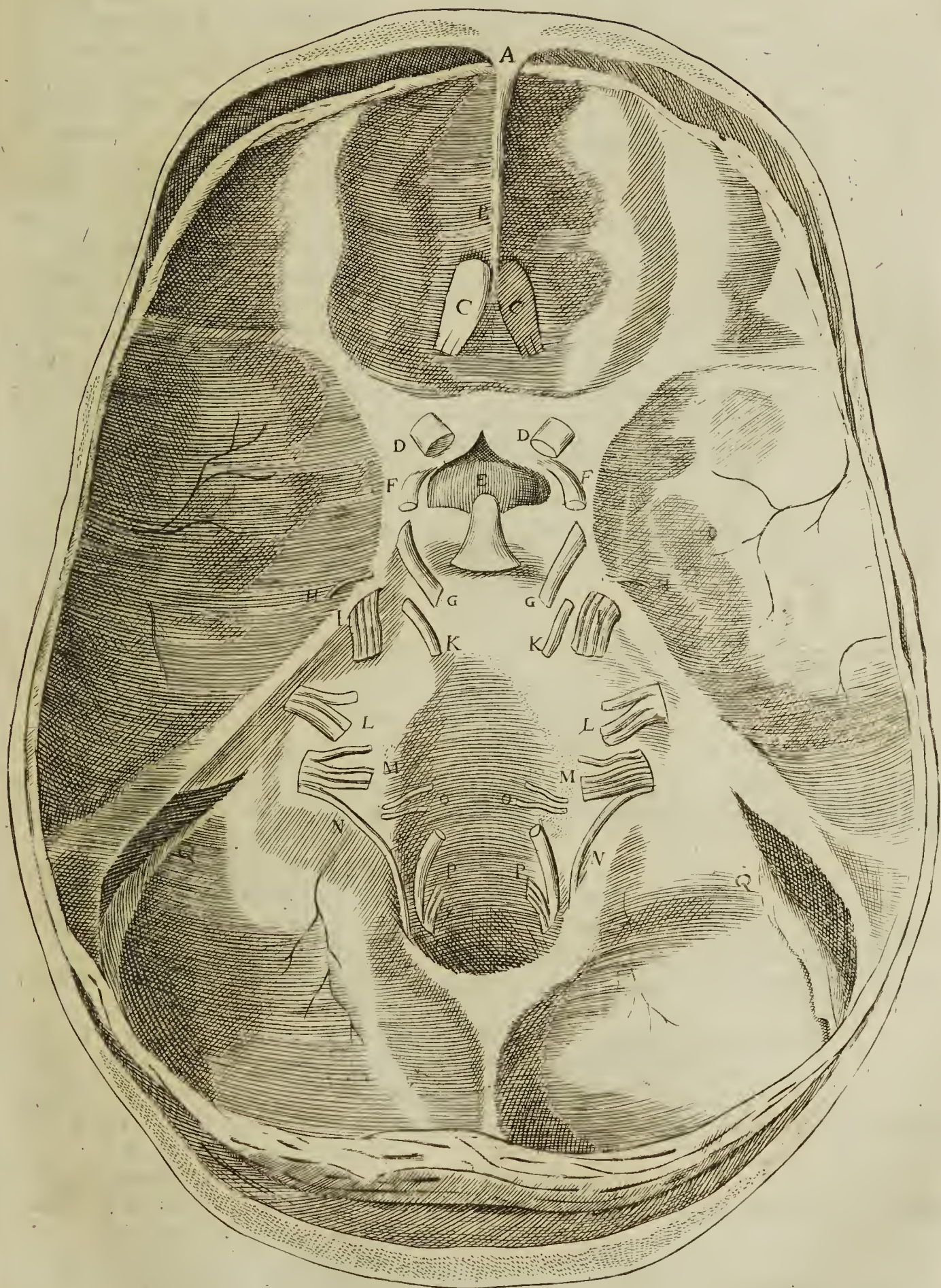
In a Dog, Fox, Sheep, Calf, Stag, and many other four-footed beasts, either of the Carotides, whilst hid within the Skull under the *dura Mater*, being divided into small shoots, and complicated with other Vessels, to wit, both Veins and nervous Fibres, constitutes the Net-like infoldings; which infoldings, being stretched out on either side of the Turkey Chair, fill the cavity there existing; then after manifold divarications of all the Vessels, some arterious shoots being disintangled from the others, and again united, grow together into one Trunk, which boring thorow the *dura Mater*, passes straight into the Brain.

The aforesaid Infolding is, commonly called the wonderful Net, and that deservedly, for there is nothing in the whole fabrick of the animal Body more worthy of admiration; in which, besides the arterious little branches which proceed from either of the ascending Carotides, the veinous shoots, though fewer, meet with those descending from the inward Jugular branches; and both kinds of Vessels being divided into small shoots, like a bundle of twisted silk, are variously folded together: which complications of the Vessels however are sustained by the nervous Fibres, supplied from the greater Trunk of the fifth pair of Nerves. The aforesaid infolding of the Vessels or wonderful Net in some Animals is far greater, and contains much more divarications of the Vessels than it hath in others; for in a Calf, Sheep, Goat, which are fed with grass, its frame is larger than in a Dog, Cat, and other flesh-eating and hotter Brutes. Further, it is observable, where the wonderful Net is greater, that the infolding of one side is ingrafted into the infolding of the other opposite side, and that from both, many more shoots of the Vessels do enter into the pituitary Kernel; so indeed, that if you shall inject Ink into the Trunk of the Artery below the Skull, the Vessels on either side, or the infoldings, will be dyed with the same tincture, and the black liquor will flow out of the Trunk of the opposite Artery.

In truth we have often seen this kind of Experiment repeated. Let the Carotidick Arteries be laid bare on either side of the *Cervix* or the hinder part of the Head, so that their little Tubes or Pipes, about half an inch long, may be exhibited together to the sight; then let a dyed liquor, and contained in a large Squirt or Pipe, be injected upwards in the trunk of one side: after once or twice injecting, you shall see the tincture or dyed liquor to descend from the other side by the trunk of the opposite Artery: yea, if the same be more copiously injected towards the Head, from thence returning through the Artery of the opposite side, it will go thorow below the Præcordia, even to the lower Region of the Body; when in the mean time, little or nothing of the same tincture is carried thorow the outward and greater Jugular Veins. Then the Head being opened, all the Arteries, before the entrance of the Head, and the Veins of the same band with them, will be imbued with the colour of the same injected liquor. Further, in the Vessels which constitute the wonderful Net, and which cover the Basis of the Brain, some footsteps of the same tincture will appear. But that this liquor doth descend so plentifully by the opposite Artery, and not by the Jugular Vein, either associate or opposite, the reason is, because it cannot enter those Veins, unless the region of the whole Brain, being first passed thorow, it had entred the bosom; but the liquor being plentifully injected, could not so suddenly pass through the very small Vessels covering the Brain: wherefore rather than the force should be carried to the Brain by the violent impulse of the liquor, it, returning from the injection, and otherwise threatening a flood to the Brain, finds the way of receding also by the opposite Arteries, for that end, both before they enter the Brain, and after they have entred it, communicating among themselves. And here we cannot sufficiently admire so provident (and to be equalled by no mechanical Art)

a dispen-

Figura V.



a dispensation of the blood within the confines of the Brain. For in as much as the Carotidick Arteries do communicate between themselves in various places, and are mutually ingrafted; from thence a double benefit results, though of a contrary effect: because by this one and the same means care is taken, both lest the brain should be defrauded of its due watering of the blood, and also lest it should be overwhelmed by the too impetuous flowing of the swelling stream or torrent. As to the first, lest that should happen, one of the *Carotides* perhaps being obstructed, the other might supply the provision of both; then, lest the blood rushing with too full a torrent, should drown the chanel and little Ponds of the brain, the flood is chastised or hindred by an opposite Emissary, as it were a Flood-gate, and so is commanded to return its flood, and haste backward by the same ways, and to run back with an ebbing Tide.

By this kind of provision the Arteries about to enter the Brain are provided: yea, and the passages of the Veins, destinated for the returning of the blood from thence, seem also to be disposed with a wonderful artifice. For when the anterior bosoms transfer their load into the two Laterals, which are the posterior, and they themselves end in the Jugular Veins, it is observed, that those latter bosoms have furrows or cavities insculped whereby they may settle or rest upon the hinder part of the Head: and whenas either bosom, through a proper hole, being about to go into the Jugular Vein, slides out of the Skull; nigh that hole, in the outward part of the Skull, a round and ample den is made hollow, and covered over by the extremity on either side of the same bosom, enlarged into a greater capacity, to the end, that the blood, whilst it slides forth out of the Head with a full torrent, should not rush into the Veins with too rapid and vertiginous an influx, and so make a forcible entry on the Heart it self, therefore it hath here a diversion large enough, in which estuating or boiling up, till a more free and open space may be granted to its course, it may be staid without any trouble. Certainly there can be nothing more artificial thought upon, and that can better argue the Providence of the great Creator, than this fit or convenient disposition of the blood in the brain, and without it, and the way of its reciprocation in divers Animals, accommodated to the necessity of every one. And lastly, in the dissection of Beasts, other miracles of the same nature happen, whereby shewing the finger and Divine workmanship of the Deity, a most strong and invincible Argument may be opposed to the most perverse Atheist.

The Fifth Figure

Shews the interior Basis of an humane Skull; where is shewn after what manner the Vessels of every kind cut off from the Brain, and about to go out of the Skull, are hid or laid up under the *dura Mater*.

A. The hollownes of the Bone of the Forehead.

B. The close or mound of the Cribiform or Sieve-like Bone.

CC. The mammillary Processes, which are much thinner, and endued with a less open cavity, than in four-footed Beasts, endued with a more excellent sense of smelling.

DD. The Optick Nerves, being far separated, go out of the Skull otherwise than in most brute Beasts.

E. The pituitary Glandula or Kernel with the top of the Tunnel inserted into it.

FF. The Carotidick Arteries shewing themselves nigh its sides.

GG. The moving Nerves of the Eyes going out of the Skull.

HH. The pathetick Nerves, hid under the *dura Mater*, go out from the Skull at the same hole with the former.

II. The fifth pair of Nerves hid under the *dura Mater*.

KK. The sixth pair stretched forth under the *dura Mater*, and go out also at the same hole with the third and fourth pair.

LL. The seventh pair entring with a double Process the stony Bone.

MM. The eighth or the wandring pair seen to grow together with an accessory Nerve of many Fibres, NN. as it goes out of the Skull.

NN. The accessory Nerve to the wandring pair.

OO. The ninth pair.

- PP. *The tenth pair tending downwards, hid under the dura Mater, where the Vertebral Artery ascends.*
 QQ. *The lateral or Side-bosom.*

The Sixth Figure

Shews the Basis of a Calfs Skull; where is shewn after what manner the Vessels cut off from the Brain, and about to go out from the Skull, are drowned under the *dura Mater*.

- AA. *The hollowneses of the spongie Bone.*
 BB. *The mammillary Processes, which, the smelling Nerves being cut off, appear hollow.*
 C. *The Optick Nerves united, being presently separated again, they go out of the Skull.*
 D. *The pituitary Kernel.*
 EE. *The Carotidick Arteries emerging nigh its sides.*
 FF. *The motory Nerves of the Eyes going out of the Skull.*
 GG. *The pathetick Nerves of the Eyes, hid under the dura Mater, going out of the Skull at the same hole with the former.*
 HH. *The fifth pair of Nerves demersed under the dura Mater.*
 II. *The sixth pair drowned under the dura Mater, and going out at the same hole with the fourth and fifth.*
 KK. kk. *The seventh pair entring the stony Bone with a double Proceß.*
 LL. *The eighth pair, or the wandring pair, with many Fibres, and an accessory Nerve, seen to grow together, going out of the Skull.*
 MM. *The ninth pair.*
 NN. *The tenth pair tending downwards, hid under the dura Mater.*

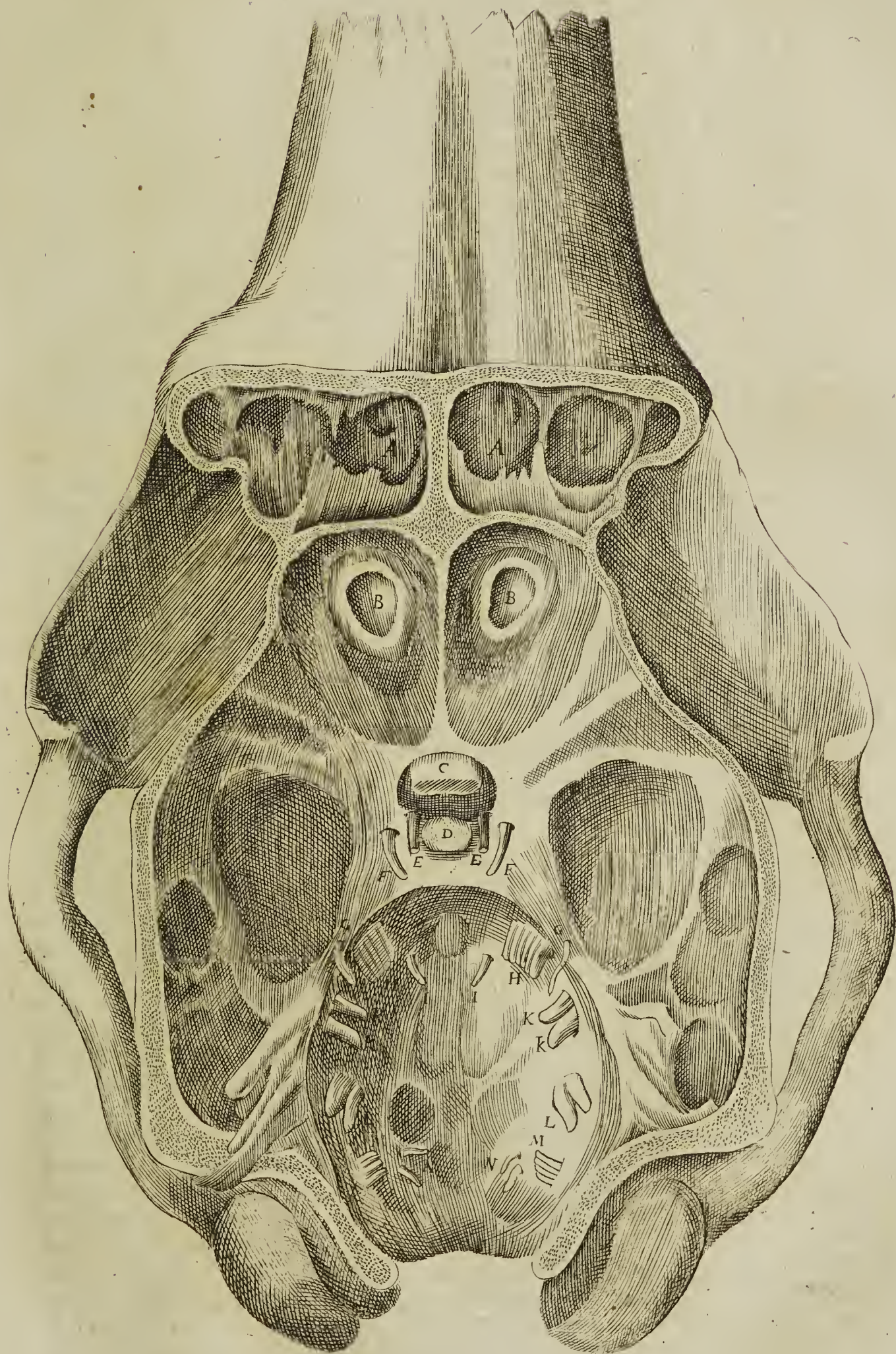
C H A P. V.

The Brains of Fowls and Fishes described.

WHat hitherto we have shewn concerning the description of the Brain and its Appendix, we chiefly owe to the observations made of the dissection of the Heads of a Man and of four-footed Beasts. We shall now proceed to the commenting upon these Observations; to wit, that we may endeavour, from the fabrick rightly considered of the parts of the Brain, so described, to erect their offices and uses, and so to design the government of the animal Function: But because a compared Anatomy may yield us a more full and exact Physiology of the Use of Parts; therefore before I enter upon this task, it will seem worth our labour to inquire into the Heads of some other Animals, to wit, of Fowls and Fishes.

We have already hinted, that the Brains of Men and of four-footed Beasts, were alike in most things; and also that the contents in the Heads of Fowls and Fishes being far different from both the former, yet as to the chief parts of the Head, are found to have between themselves an agreement. The kinds of either Animals being coetaneous, and as it were Twins from the Creation of the World, do testify their affinity in nothing more than in the fabrick of the Brain. That it is so in Man and four-footed Beasts plainly appears already: we shall now see if that the Anatomy of Fowls and Fishes will shew us any thing worthy of note.

That we may begin with Fowls; the covering of the Skull being taken off, the hard Meninx or Membrane embraces strictly the bulk or mole contained within. In the midst of it, where the brain is divided into two Hemispheres, it hath a bosom stretched out at length, which notwithstanding, no *Falx* (or *Scythe*) being let down between the interstices, is inserted less deeply in the brain: then, where this Membrane distinguishes between the brain and the Cerebel, two lateral bosoms are formed. Besides, in Fowls there is a fourth bosom, which hath its place a little more backward than in a man or four-footed beasts; for a little below the pineal Kernel a hollow and smooth proceß of the hard Meninx is sent down upon the shanks of the oblong marrow, where presently it is divided into two branches, on either side whereof it sends forth one upwards into the cavity between the streaked Membrane and the



the Hemisphere of the brain, planted in the hinder part of the brain.

This superior Membrane or hard Meninx being cut off, and separated round about the *Pia Mater*, appears very thin, which is not, as in man or other perfect Creatures, marked with such frequent infoldings of the Vessels; but this most subtil Meninx being made of a texture of Fibres, only clothes, and every where intimately binds about the even and plain superficies of the brain contained within, and wholly destitute of turnings and windings about.

The fabrick of the brain in Fowls is otherwise than in man or four-footed beasts: for besides that in its compass the inequalities and the turnings and windings are wholly wanting; also more inwardly, the callous body and the *Fornix*, as also the chamfered bodies, which we described before, are all lacking: and besides, the substance of the brain it self is figured after another manner. That these may the better be beheld, make the dissection of the brain of a Goose or a Turkey-Cock; and the Membranes being cut off, by pressing lightly the fissure or cleft of the brain, you may divide the middle of it one from another, and go forward to separate it, till you come to its bosom, in which place are two marrowy bodies, which being stretched out like Nerves, connect the Hemispheres one to another. Either side of the *Interstitium* or the space between, is clothed with a whitish Membrane, which is marked with streaks or beams, lying or running from the whole compass or circumference, to the lower corner; and these streaks concenter about the infertions of the medullary bodies. Then, if this Membrane be cut, in either Hemisphere of the brain, there will appear underneath a cavity, which goes under the whole space, from the side of the *Interstitium*, and for a great part, the hinder region of the brain, and is arched or chambered with that streaked Membrane. Either cavity or hollowness, about the bottom, is opened into an intermediate or common passage, which lies open to the Tunnel; and from either side of this passage the shanks of the oblong marrow are stretched out, to which, on either side, the Hemisphere of the brain is hung by two medullary bodies; to wit, one marrowy or medullary body goes out from the mole or substance of the brain lying under the Ventricle, the other from the streaked Membrane covering the Ventricle. From these two, placed on either side, the medullary bodies being stretched out cross-wise, like Nerves, joyn the two Hemispheres of the brain to one another. Besides, these two growing together on either side, fix either Hemisphere of the brain to the shanks of the oblong marrow.

So the figure of the Brain in Fowl, if you compare it with the brain in men and of the more perfect four-footed beasts, seems to be as it were inverfed. For as in these the Cortical part is outward, and the medullary laid under it; so in Fowls, the lower frame of the brain, which consists of a thick and closer substance, is instead of the *Cortex* or shell; but the outmost and upper Membrane, chambering the Ventricle, appears medullar or marrowy above any other part. Moreover, the Ventricles in the brains of a man and four-footed beasts are placed beneath, and near the bottom; in Fowls, above and nigh the outward border. The reason of this difference seems to be, because in a more perfect brain, such as is in man and four-footed beasts, the animal Spirits have both their birth and exercise; viz. they are procreated in its Cortical or shelly part, and in its medullary, which being large enough, lyes under this, they are circulated and variously expanded for the acting of their faculties. But truly in the brain of Fowls there is space enough for the generation of Spirits, but for their circulation there is scarce any left: to wit, the brains of Birds seem not to be much possessed with the gifts of phantasie or memory: yea it is thought, that the Spirits begotten in the brain are exercised chiefly in the oblong marrow for the preserving the animal function; for there, as we shall shew anon, the medullary substance, which is instead of the callous body, consists; and like the streaked bodies in others, in these are streaked Membranes, through which the Spirits, procreated in the brain, are carried, without any order there, forthwith into the oblong marrow: but because the Spirits, begot in the brain, ought to lay aside a ferous excrement; therefore the Ventricles, from the complicateure of the streaked Membrane upon the keel or lower part of the brain, and on the shanks of the oblong marrow it self, do serve conveniently enough for this business. Notwithstanding, because in the brains of Fowls, the *Fornix* is wholly wanting, there are only two anterior Ventricles; between which, the Choroides infolding is stretched out; the veinous portion whereof, as was but now said, arises a little lower from the fourth bosom; but the Arteries ascending, come from either side of the oblong marrow.

Nor

Nor is there a greater heterogeneity or difference of conformation in the Brain itself of Fowls, than in the oblong marrow from the same in men and four-footed beasts. For in the first Section, from whence the Optick Nerves arise, two noted protuberances grow to either side. These are much greater in proportion than the orbicular prominences in the more perfect Creatures; so that they seem another additional brain: either of them of a white colour, and purely marrowy, is hollow within; so that in these kind of Animals are found two bellies or Ventricles in the brain, and as many in the oblong marrow. And seeing in these, as in all other Animals, a cavity is put under the Cerebel, the Ventricles in the whole Head differ as well in number as in figure and position.

In the middle of the medullary Trunk, to wit, where those prominences grow to its sides, the Chink, leading to the Tunnel, is cut, but into it the aperture of either Ventricle gapes or opens, that it is not to be doubted, but that the serosities heaped up there, are sent out by that way. Moreover it is likely, that these hollow and medullary prominences in Fowls supply the course of the callous body, to wit, in which the animal Spirits are circulated for the exercising their faculties: because in the brain the space is so narrow, that the Spirits cannot be produced and circulated together within its confines. Further, as in Fowls, the use of the animal Spirits is required for the act of the sensitive and loco-motive faculty, more than for phantasie or memory; certainly the chief place where they may meet and be exercised, ought to be placed rather in the oblong marrow than in the brain.

The Carotidick Arteries, which carry the blood to the brains of the greater Birds, are so small, that there is no proportion of these to the same in man and four-footed beasts. Their Trunks being carried within the Skull, ascend without any branchings into net-like infoldings, alter the same manner as in other Animals, nigh to the pituitary Glandula, and pass right into the brain, and distribute some small shoots of the Vessels both to its exterior compass, and through its inward recesses. But in truth, the brains of Birds are watered with a very small portion of blood, in respect of other living Creatures; because, where the fancy or imagination is little exercised, there is not much blood required for the refreshing the animal Spirits.

Fowl (otherwise than some affirm) have both the mammillary processes, and the Cribrous or Sieve-like bone. For the anterior productions of the brain being highly extenuated and involved with the *dura Mater*, stretching out almost to the middle part of the bill, are inserted into the triangular bone, which hath a double bosom, distinguished between with a thin mound or pale. But these processes being dilated within the bosom of the aforesaid bone, and in Bladders full of clear water, which are very like the mammillary processes in a Calf, full of clear water. Besides, as out of the fifth pair of Nerves, a noted branch on either side passing through the ball of the Eye, enters into the cavern of the Nostril, a shoot of it being sent out of the Trunk, is bestowed to the very orifice of the Nostrils; in the mean time, both the greater Trunks, compassing about the Cribrous bone, meet together, and presently going one from the other, and being carried to the end of the bill, are distributed into the palate. After this manner Fowls, even as men and four-footed beasts, are furnished with a peculiar organ of smelling, to wit, with a double mammillary process; and besides, they have within the Nostrils additional Nerves out of the fifth pair, by whose action and communication of branches into other parts, and among themselves, so strict an affinity is contracted between the smell and the taste. The other pairs of Nerves are almost after the same manner as in men and four-footed beasts. In like manner we also observe, that there is no great difference as to the Cerebel and the other portion of the oblong marrow, between Birds and the other Animals we have already considered on, unless that the orbicular prominences before the Cerebel, and the other annular under it, meeting within them, are both wanting in Fowls; indeed these latter seem not at all to be required; but instead of the former, they are easily supplied from the hollow medullary prominences, such as we have shewn to be in Fowls.

And these are what are chiefly worth noting to be found in the brains of Fowls. We have already mentioned, that there is a certain likeness between these and Fishes as to the most parts of the head: wherefore it will seem to be to the purpose, that here for a conclusion we should say something of the brain of Fishes. First, we shall observe, that as the heads of Fishes, in respect of the whole body, are greater than of any other living Creatures, yet they contain in them less brain than others. For

two little moles or substances, placed before, sustain the whole place of the brain, properly so called; out of these, two signal smelling Nerves proceed, which are carried by a long and straight journey to the holes made hollow, out of either side of the mouth, and which are instead of nostrils: and this is singular to Fishes. Moreover, we advertise concerning the Optick Nerves, that they, as in other living Creatures, inclining mutually one to the other, are not however united; unless perhaps towards the superficies; but they are crossed, and a Nerve arising from the right side of the oblong marrow, is carried into the left Eye, and so on the contrary: so indeed, that the visory rays have their refraction, not only in the Eye, but within the very bodies of the Nerves. The oblong marrow in Fishes, wholly after the like manner as in Birds, hath two signal protuberances hollowed within; and in truth, as to local motions, the Spirits in either seem to be exercised after the like mode. For as Fishes swim in the water, so the flying of Fowls or Birds seems a certain kind of swimming in the Air. Further, in these 'tis observable, there are the pituitary Kernel, the Tunnel, and the Carotidick Arteries as in other Animals; also many pairs of the Nerves have the same origines and distributions, excepting that the hearing Nerves are here wanting; although *Cassernus Placentinus* attributes this gift to the smelling Nerves. The figure of the Cerebel is the same as in more perfect Animals. Besides, what we have remarked concerning the wandring pair of Nerves in man and four-footed beasts; to wit, many fibres of it arising together, the trunk of the Nerve from the spinal marrow comes to them: in like manner the same is in Fishes. But to describe them all further is needless: for the rest, as those which are proper to them only and Birds, as also those which they have common with Fowls and the more perfect Animals, may be easily known, partly out of the peculiar similitude with birds, and partly out of the universal Analogy of all. Therefore we will now philosophise upon the Use and Action of the Brain and its Parts, and of its Appendix, together with the whole œconomy of the animal Function: where in the first place, we will inquire into the offices of a more perfect Brain, such as of man and four-footed beasts; and also secondarily and collaterally we shall explain the Offices and Actions of a less perfect Brain, and of its Parts, such as that of Fowls and Fishes.

CHAP. VI.

Of the Offices of the Brain and its Parts: where first of all the Uses of the Skull and the hard Meninx or Dura Mater is treated of.

THE Poets feigned *Pallas* to be formed within the Brain of *Jupiter*, and from thence to be born. In truth, within the Womb of the Brain all the Conceptions, Ideas, Forces, and Powers whatsoever both of the Rational and Sensitive Soul are framed; and having there gotten a species and form, are produced into act. Wherefore it will be worth our labour to inquire into these places, of the generation of these more noble faculties, and the first rise and primitive beginnings of them, as also more curiously to consider the divers parts of the Brain, or the Organs serving to their Generation: And I go about this part of my labour the more willingly, that I may by handling the thread of our dissection again, bring all the Phænomena, before given to our inspection and sense, before the Eye of Reason, and to be again weighed by a more severe Examination of Discourse; at least those things which seem to be of the greater moment, and chiefly worth taking notice of. Neither do we think here to heap up into a great Volume the several things worn out by the handling of others, and offered to common observation.

Therefore recollecting the Anatomy of the Brain, the first things to be considered are its coverings, to wit, the Skull, and the two Meninxes or Maters. Concerning the first it is observed, that all perfect Animals have an hard and bony Skull. A double reason for which may be given: First, that the Head being destinated for the most noble use, might be protected with a more firm and not easily penetrable covering, as a natural Helmet, against the injuries of external strokes; besides secondly, as this is in the place of Armor, so also of a Cloister; because the same covering the *dura Mater* within, may restrain and keep within the Brain the Effluvia's of the animal

mal Spirits, lest they should too thickly evaporate, or in heaps. Further, as the Skull for these ends is made bony; the efficient cause are the saline Particles of the blood watering the brain, which being unprofitable to the interior work of the animal Spirits, and so to be sent away outwardly, grow together thus in the circumference, and are congealed into a stony hardness: For indeed the blood being carried towards the Head, as it abounds very much in Spirit, so in Salt; its Particles highly volatile, being joyned to the Spirits, are bestowed on the brain; in the mean time, the saline little bodies, which are of a more fixed nature, being thrust out into the circumference, from the Spirit implanted in the Brain, constitute the stony Skull, as it were a bubble covering inclosed wind.

Within the hollow superficies of the Skull, there appear many furrows and inequalities imprinted by the protuberances of the Vessels; and we perceive frequently either border or plate of it to be perforated by the passing through of the Vessels in several places: but the Arteries, arising in the exterior superficies of the *dura Mater*, make these kind of little ditches through the concavity of the Skull. For when the whole substance of the brain is at first soft, and easily giving place, like Wax; the Arteries underneath it continually beating, as it hardens by degrees, easily imprint the marks of their tracts.

The figure of the Skull in four-footed beasts is narrow and prest down, but in man, the substance of whose brain is large, there is required a more capacious and almost spherical figure. For as God gave him an upright countenance to behold the Heavens, and also endued his brain with an immortal Soul, and fitted for the speculation of Heaven; therefore his face is erect or lifted up: so the brain it self is placed in a more eminent place, to wit, above the Cerebel and all the Sensories. But in Brutes, and such whose faces are prone towards the Earth, and have a brain unfit for speculation, the Cerebel, however serving to the more noted action and office of the Præcordia, is placed in the highest seat to which the mole of the brain is subjected. Besides, some organs of the Senses, to wit, the Ears and Eyes, if they be not superior, they are placed at least equal to the brain. In an humane Head, the Basis of the Brain and Cerebel being placed nigh together, yea of the whole Skull, is made parallel to the Horizon; whereby it comes to pass, that there is less danger for any portion of the Head to be jogged here and there, or to be moved out of its proper seat: But in four-footed beasts, who go with an hanging down head, the Basis of the Skull makes a right angle with the Horizon; wherefore the brain being subjected, the Cerebel is put in the highest place; so indeed, that this seems less stable, and that it may shake, or be moved from its seat. However against this inconvenience, lest a frequent concussion of the Cerebel might induce a sinking down or loss of the Spirits, or irregularities about the Præcordia, in some it is taken care of by a wonderful artifice of Nature; for as in all the frame or substance of the Cerebel is most strictly bound fast together by the *dura Mater*, besides in some it is staid by a bony fence; but in others, as in a Hare, Rabbet, and other lesser Brutes, a certain portion of the Cerebel is included on either side by a stony bone, and so by this double hold its whole bulk or substance is firmly tyed to the Skull. Concerning the chief bones of the Skull, viz: the Cuniform or Wedge-like bone, the Cribrous or Sieve-like bone, and the auditory or hearing Organ, they shall be spoken of in their proper places, when we come to treat particularly of the Ventricles of the Brain, and of the Senses to which these bones serve. We shall pass next to the hard *Meninx* or *dura Mater*.

The *dura Mater* or hard *Meninx*, formed of a double kind of Vessels and Processes, bears also a double Aspect, and owes part of its office to the Skull, that is about it, and part to the *Encephalon* contained within it. The exterior processes of this Membrane are insinuated within all the bosoms and cavities of the Skull; to some whereof they are a covering and defence, but to others they impart a sensible force; which manifestly appears in the Sieve-like bone, through whose holes the fringes of this Membrane passing, conduce something to the sense of smelling. Also the productions of this, lying over the recesses and caverns of the Wedge-like bone, fortifie the ways for the entrance and coming out of the Vessels. The interior processes of the *dura Mater*, which belong to the Head, divide and distinguish between the parts of the brain and Cerebel; and in those places the *dura Mater* is very thick, lest in any great concussion of the Head, these two should be smitten one against another, and should press one upon the other. Wherefore in Dogs (as we have already hinted) who are wont to run violently with their heads down, there is sent down between these bodies

bodies a bony fence. In like manner in a Cat, Horse, Fox, and many other Animals, from whose manner of living and use it is required, that they be moved with a swift motion, that bony fence, commonly called the Triangular Bone, is sent down deeply between the Brain and the Cerebel; yea, and all the bosoms pass through that bone in the holes curiously made hollow in it.

The Vessels belonging to the *dura Mater* are either Arteries, that carry the blood thither; or they are Veins, which receiving from thence the superfluous blood, and from the whole Head besides, return it towards the Heart. As to the first sort of Vessels, on either side, two Arteries arising from the Carotidick Artery on the same side, before it comes to the Basis of the Brain, are carried into the *dura Mater*; which notwithstanding, only possessing the exterior superficies or convex part, carry blood and juyce to this Membrane, also in some measure to the Skull and its coverings. As to the Vessels carrying the blood back, this Meninx contains four, into which, as into a great Sea, all the Rivulets of the Arteries, serving the whole Head, do exonerate themselves: to wit, there are observed in this Membrane four noted Cavities, commonly called Bosoms; which are disposed after that manner, that, like Promptuaries or Store-houses framed in several places, they receive the blood returning from every region and corner of the brain: For the third bosom, or the longitudinal, looks towards the anterior brain, the fourth towards its middle; but the first and second admit the blood flowing back from the Cerebel and hinder part of the brain. Further, out of these the third and fourth disburden themselves into the first and second; and these at length transfer their burden into the Jugular Veins. On every side, from these bosoms, the lesser Vessels, viz. the chanel of the Veins are sent forth, which going out nigh the interior or concave superficies of the *dura Mater*, are presently inserted into the *Pia Mater*, and following its protension, being distributed through the whole compass, and all the interior recesses of the brain and its Appendix within the Skull, and being complicated with the Arteries, receive the superfluous blood, and carry it into those greater cavities. That it is so, it plainly appears, because if you squirt a liquor, dyed with Ink, into the Pipe of the Artery, that passing through the arterious shoots, and then the veinous, goes through at last into the bosoms.

Whilst the blood, returning from the whole interior Head, is collected within those bosoms, as with a full belly, it seems also in another respect to be of a very notable use; to wit, for the supplying of heat, requisite for the distilling forth of the animal Spirits, as if it were a certain Chymical operation. For as much as the blood to be distilled, is contained in the Vessels, interwoven into the *Pia Mater*, the superior Rivers diffused on every side through the *dura Mater*, the heat being brought to it like a *Balneum Mariae*, flow about the underlying blood, and so force out of it a most subtil Liquor into the substance of the Brain; or rather, the blood raising up heat within the bosoms, is like the fire of suppression, which in the distillation by descent, is inkindled round about the Vessel containing the matter to be distilled. For indeed the interior substance of the Brain, for that it is endued with plenty of Salt and very little Sulphur, is of a more frigid temper: wherefore, that from the blood watering its superficies, the spirituous part may be stilled forth, and forced into its middle or marrow, the degree of the ambient heat ought to be made the more strong, such indeed, as the blood collected in the ample Estuaries of the bosoms, may easily afford. Further, as those bosoms being distended with heated blood, are like a certain distillatory Bath; so the other Membrane of the *dura Mater* being stretched out about the whole Head, is like an impervious Alembick, which with its covering keeps within the spirituous breaths, that they may not be immoderately evaporated.

Concerning this Membrane there may yet be considered, with what motion or sense it is endued. And as to sense, 'tis not to be doubted, but that it hath it exquisitely: For since all the Membranes have feeling, and owe that faculty to the afflux of the animal Spirits from the Brain, surely this Meninx, for that it is nearer and very much of kin to the Brain and its Appendix, so that it clothes very many Nerves going out of the Skull, it obtains a very accurate virtue of feeling: which thing also may be argued from the effect; because the pains of the Head often proceed from the breach of unity excited in this Membrane. But that it hath motion, it can hardly be thought, because it is tyed in very many places to the Skull; and yet it is probable, that the same may sometimes, in some parts at least, be contracted and wring-

led or drawn together : And certainly there is no doubt, that it is contracted and remitted in sneezing. In like manner, when from an hurt of this a Vomiting or Convulsive motions follow in the *Viscera* or Members, this Membrane is the cause, which being somewhere contracted or divided, infolds with it self the substance contained within with the same Convulsion or Spasm.

Concerning the motion of this Membrane, a curious mind may yet further consider its texture, and especially how it is within the cavities of the bosoms, and the *Interstitium* or separation of the Brain and Cerebel. For in these places are found many Fibres, or as it were greater or nervous cords or strings, such as we have observed to be variously stretched out in the Ventricles of the Heart. Within the bosoms, from the various processes of the Membrane, a cavity full of turnings and windings, and manifoldly divided, as it were with many little Cells, is constituted. This seems to be thus made, to this end, to wit, that the blood returning back from divers little rivers into the cavities of the bosoms, may be retarded by several obstacles, as it were little flood-gates; lest perhaps rushing too impetuously and by heaps, it might flow within this Sea with a vertiginous and inordinate motion. But there is observed, besides these intrications and little cells of this Meninx in the heads of four-footed beasts, that moreover in the whole cavity of the bosoms, very many cords, as it were Ligaments, are every where produced from one side to the other. The office of these is partly, that they may contain the sides of the cavity within their due ends of aperture and dilation, lest they should be distended above measure by the vehement rushing in of the blood, and so may press upon the substance of the brain. Yea the contexture of these whitish Fibres, which are met with, both within the cavities of the bosoms, and in this Meninx, going about the Cerebel, and distinguishing between it and the Brain, seems to intimate, that they serve also to some motion. For it may be suspected, that those strong Fibres, and as it were Ligaments, do sometimes contract, sometimes dilate, and variously draw the Membrane to which they are knit. From these kind of motions of the *dura Mater*, the blood flowing within the bosoms, may be variously agitated, and as occasion serves, sometimes hastened in its Circle, and sometimes restrained or hindred; for in many affections of the sensitive Soul, the blood being disturbed from its equal circulation, is sometimes precipitated by heaps and impetuously to the Heart, and sometimes detained from its nest longer, nigh the confines of the Brain. But that various whirlwinds of passions stir up such irregularities in the motion of the blood, the nervous parts implanted about the *Præcordia*, are in some measure the cause, which by contracting or dilating the same, variously moderate the course of the blood; yet so, that in the mean time, some part of this office is due from the brain it self, or at least to its Appendix. Indeed the brain it self wants motion; but the blood passing through its substance, for as much as it is poured wholly in this Meninx, and passes through its receptacles, is at the motion and beck of this Membrane, sometimes driven away from the brain, and commanded to succour the Heart, as in fear and great sadness, sometimes being hastened towards the brain, is for some time prohibited from flowing back, as in shame, indignation, and some other affections.

Truly, that these kind of interior processes of the bosoms, and as it were transverse strings or cords, do conduce to the more commodious reduction of the blood, we gather also from hence, that in working beasts, whose brain (because they feed and go with a prone and hanging down head) is in greater danger of an inundation of the blood, those processes are very big, for that they being successively contracted, may leisurely thrust out the blood, apt otherwise to stagnate by reason of the inclination of the head. Neither is it from the purpose to observe here, that these same Animals are always furnished, for that reason, with a greater wonderful Net: by which means indeed it is provided, that the blood may not too much invade the brain by heaps; as care is taken by the artifice but now described, lest the same should make too long stay in the brain, and so oppress its more weak frame.

Therefore in the last place, that I may recollect what I have said of the *dura Mater*, and rehearse its chief uses: First, It covers over the Skull within, and reaches to it somewhat of nourishment by the Vessels. Secondly, It is a covering to the whole head, and serves to distinguish its chief parts. Thirdly, It contains the Vessels designed for the reducing the blood from the whole interior head; which, in the mean time, by reason of the plenty of the blood contained in them, and the opportunity of their situation, administer requisite heat for the distillation of the Spirits. Fourthly, It provides

vides ways for the admission and going out of all the Vessels within the Skull, and fortifies them; to which may be added, that it bestows on some of them their Coats, as shall be shewn anon. Fifthly and lastly, This Meninx being here and there contracted or divided by the animal Spirits variously moved, according to the passions of the Soul, or the necessities of Nature, stays the blood sometimes longer near the confines of the Brain, sometimes drives it forward from thence towards the *Præcordia*.

C H A P. VII.

Of the thinner Meninx or Pia Mater, of its stretching out, as also of the Infoldings of the Vessels every where interwoven with it.

THE interior *Meninx* or *Pia Mater* is far thinner than the exterior, and consists of a most subtle contexture of Fibres. This does not compass about the *Encephalon*'s superficies as loosely as the *Dura Mater*; but embraces it so very strictly, that it is very hardly separated from it: besides, it insinuates it self into all its turnings and windings and furrows, and clothes their inward parts. Further, this *Meninx*, although it be thin, yet being covered over throughout with the infoldings of Arteries and Veins, is interwoven with them, and so waters all the spaces of the Brain and Cerebel with innumerable rivers. For as the Region of either of these, especially of the Brain, is full of turnings and windings, this Membrane in like manner grows to the deep furrows of the crankling turnings about, and also to the tops of the ridges; yea, the chief complications of the Vessels are still placed in the vallies, as if they were there hid in regard of their safety. Neither doth this *Meninx* only cover the gapings of the turnings and windings about; but also gathers together the tops or heights of all their interstices or places between, and knits them together, and so makes the whole superficies of the Head plain, globous, and as it were like the World.

That the diffusion of this wonderful Membrane into all the turnings and windings of the Brain, and the distribution of the Vessels through those most intimate recesses, may be the better beheld; let the head of a man, or of a brute beast that dyed of the Dropsie, be opened: For in such, whose brain abounds with much moisture, the little stays, whereby this Meninx is fixed to the substance of the brain, are loosned, so that the Membrane, with the infoldings of the Vessels, may be easily drawn away, and pulled off almost whole: which indeed being pulled off, the folds of the brain will appear naked; also the insertions of the Vessels every where into the more inward substance of the brain, may be perceived. But to a sound and dry brain the *Pia Mater* sticks so closely, that it can scarce be drawn away in any part, or separated with a Penknife.

We have already shewn after what manner the Veins and Arteries (which creeping like Ivy, are knit into the *Pia Mater*, and variously interwoven into it) cover over with most thick little shoots, the whole compass of the Brain and Cerebel, and their Interstices, the gapings of the crankling turnings and windings about, bosoms, and cavities, and send forth every where small shoots into the medullary substance; so that it is not to be doubted, but that the animal Spirits, being as it were stilled forth immediately from the blood, every where in the whole head, are received into the Pores and passages of the Brain and Cerebel. From hence it will be easie to assign the use or office of the *Pia Mater*: viz. First, this Membrane clothes the universal parts of the whole *Encephalon*, and distinguishes them all one from another. For indeed, this lying over all the gapings and interstices of the turnings and windings, is instead of a mound or fence, by which the animal Spirits are restrained every where within their proper cells and orbs of expansion, nor are they permitted by this means to run beyond their bounds, and so confound the acts of the many Faculties. Then secondly, this Meninx sustains all the blood-carrying Vessels, viz. both the Arteries and Veins, together with their manifold productions, and so affords a passage to the blood, by carrying it to and fro towards the brain.

Concerning these Vessels, which are knit to this Meninx, and follow its stretching

out into all parts, there are many admirable things to be met with, and highly worthy of note, the uses and reasons of which is our purpose to search into.

As to these, we shall first observe, that these Arteries and Veins, otherwise than in any other part of the body besides, not arising nigh one another go forth as companions, but going forth from opposite ends, meet every where mutually, viz. the Arteries ascend from the Basis of the Skull, and by creeping through the whole, emit upwards shoots and branches, which are met by the Pipes of the Veins arising out of the bosoms, and carried downwards. By this means the rivers of the blood seem to be made equal every where in the Brain, viz. whilst the smaller shoots of the Veins follow or match the greater branches of the Arteries, and on the contrary, the small branches of the Arteries the Trunks of the Veins.

Secondly, We have already shewn, that these Vessels are variously and very much ingrafted or inoculated among themselves, not only the Arteries with the Veins, but what is more rare and singular, Arteries with Arteries; to wit, the Carotidick Arteries of one side, in many places, are united with the Carotides of the other side; besides the Vertebals of either side among themselves, and are also inoculated into the posterior branches of the Carotides before united. The joynings together of the Carotides, in most living Creatures, are made about the Basis of the Skull under the *Dura Mater*, and that after a diverse manner; in some communicated through the Vessels of the wonderful Net from one side to the other; in others (as in a Horse we have observed with a certain admiration) the arterious chanel is produced between the Trunks of the *Carotides*, whereby the blood may be carried from one side to the other, and so on the contrary. But besides, between the *Dura Mater*, about the Basis of the Head, the same kind of ingraftings of the Arteries are still seen in man and all perfect four-footed beasts.

The reason of these seems to be partly, that the blood to be carried from the Heart into divers Regions of the Brain, might be exactly mingled as to its parts and particles, before it come to the place designed. For the Torrent of the blood, because divided into lesser rivulets, is incident to languish in so long a circuit, and its Spirits to be depauperated, and lastly it self to grow cool; unless that various courses of its *Latex* should anew inkindle this vital flame about to be extinguished or dye.

But there is another reason far greater than this of these manifold ingraftings of the Vessels, to wit, that there may be a manifold way, and that more certain, for the blood about to go into divers Regions of the Brain, laid open for each; so that if by chance one or two should be stopt, there might easily be found another passage instead of them: as for example, if the *Carotides* of one side should be obstructed, then the Vessels of the other side might provide for either Province. Also as to the *Vertebral* Arteries, there is the same manner of provision made. Further, if both the *Carotides* should be stopped, the offices of each might be supplied through the *Vertebals*, and so on the other side the *Carotides* may supply the defects of the shut up *Vertebals*.

After this manner, lest there should be wanting an afflux of the blood at any time in any part of the Brain, or its Appendix, within the Skull, there is care taken with singular Art: For as there are four distinct passages, and those remote one from the other, of this *Latex*, if perchance three of them should happen to be shut up, the blood being carried through one only, will soon supply or fill the chanel and passages of all the rest. Which thing I have found by Experience often tryed, not without admiration and great pleasure. To wit, I have squirted oftentimes into either Artery of the *Carotides*, a liquor dyed with Ink, and presently the branches on either side, yea and the chief shoots of the *Vertebals*, have been dyed with the same tincture: yea, if such an injection be sometimes iterated by one only passage, the Vessels creeping into every corner and secret place of the Brain and Cerebel, will be imbued with the same colour. Also in those who have the wonderful Net, the Tincture or dyed Liquor being injected in one side, it will come through the Net-like infoldings of the Vessels in both sides. Hence it plainly appears, that there is a communication between the Vessels watering the whole Head; and although every Artery is carried to one only Region, as its peculiar Province, and provides for it apart; yet, lest that any part should be deprived of the influence of the blood, more ways lye open to every part by the ingraftings of those vessels; so that if the proper vessels by chance should be wanting in their office, its defect may presently be compensated by others neighbouring.

It is not long since we dissected the dead body of a certain man, whom a great

Scirrhus or hard Swelling within the *Mesentery*, growing at last ulcerous, had killed. When his Skull was opened, we beheld those things belonging to the Head, and found the right *Carotides*, rising within the Skull, plainly bony or rather stony, its cavity being almost wholly shut up; so that the influx of the blood being denied to this passage, it seemed wonderful, wherefore this sick person had not dyed before of an *Apoplexy*: which indeed he was so far from, that he enjoyed to the last moment of his life, the free exercise of his mind and animal function. For indeed, Nature had substituted a sufficient Remedy against that danger of an *Apoplexy*; to wit, the *Vertebral Artery* of the same side, in which the Carotidick was wanting, the bulk of the Pipe being enlarged, became thrice as big as both its Pipes on the other side: because, the blood being excluded the Carotidick, adding it self to the wonted provision of the *Vertebral Artery*, and flowing with a double flood into the same belly, had so dilated the chanel of that Artery above measure. This Gentleman, about the beginning of his sickness, was tormented with a cruel pain of the Head towards the left side. The cause whereof cannot be more probably assigned, than that the blood excluded from the right Carotidick Artery, when at first it rushed more impetuously in the left, had distended the Membrane; and therefore the same distemper did afterwards vanish of its own accord, to wit, the superfluous blood being derived through the *Vertebral Artery*.

Thirdly, Concerning these sanguiferous Vessels covering the *Pia Mater*, we observe, that the Arteries and Veins, whilst they meet one another, going out from opposite ends, do not only transfer their burden immediately through the several branches or shoots, mutually ingrafted, as is wont to be done in other parts of the Body; but being variously complicated and interwoven, do constitute every where admirable infoldings, into which, for the most part, very small and very numerous Glandula's or Kernels are inserted. Which thing is seen, not only in the infoldings, which are called *Chorooides*, (by which name, besides those which are found within the plicature or folding up of the Brain, we also intend others planted together behind the Cerebel) but these kind of infoldings of the Vessels, with Glandula's sowed between, are seen every where to be sprinkled through the whole compass and interior recesses of the Brain and Cerebel, and especially between the gapings of their turnings and windings and interstices. This is clearly manifest in a moister Brain, or in an Hydropical, where the very small Glandula's, which otherwise are scarce to be seen, being intumified by the moisture, are easily beheld. Moreover, from the aforesaid infoldings, on every side implanted, little slender Vessels, being every where sent forth, enter the Cortical, and in some measure the medullary substance of the Brain and its Appendix; for if you squirt into the *Carotides* a black liquor, besides the shoots of the Vessels, which it dyes every where with the same colour, little blackish pricks will appear sprinkled in the substance of the Brain. Further, if the brain of a living Animal be cut up, the live blood will spring forth both from its *Cortex* and medullary part. The reason and end of all which, if they be inquired into, it seems that these foldings of the Vessels, being variously complicated with repeated windings about, as if they were little serpentine chanel hanging to an Alembick, through whose narrow straits the blood passing with a long circuit, becomes still more subtil and elaborated; to wit, its thicker part, being by degrees put off in its passage, or sent away by the little branches of the Veins, and so at length the only pure and most spirituous blood, and it self now ready to go into animal Spirits, is admitted within the Pores and passages of the brain. But as the blood or sanguinolent part is supped up by the Veins, so it's very likely the Serum or watry part is received by the Glandula's or Kernels interwoven in them. For it appears not for what other end these Arteries are every where beset with so many Kernels, unless they should lay up in them the superfluous serosities. Between these infoldings there appear not any Nerves to be found, which may require any juyce or serous humor from these Kernels; and 'tis not yet found, whether these Lymphæducts or Water-carriers be accompanied with any Vessel: wherefore it may be lawful to suppose, that whilst the purer and spirituous part of the blood, being separated from the rest of its mass, is stilled forth into the brain, the serous humidities are received by the Glandula's, which are numerous, and that they are for some time retained by them, till they may be sent away into the Veins growing empty again.

Thus far we have beheld only the superior branchings forth of the blood-carrying Vessels, which are every where interwoven in the *Pia Mater*; and their infoldings, which

which like the leaves of a Wood, or creeping Ivy, cover the exterior compass of the whole Head. But by what means, and as it were Chymical Artifice, these Vessels do instil the animal Spirits into the Brain and Cerebel, and serve for the use of one another besides, shall be told anon, after we have considered of the inferior Aspect and next the ground of this most thick Wood, *viz.* the greater Trunks of all the Arteries, which are destinated for the Brain, where they pass through the Skull, and shew themselves beyond it.

C H A P. VIII.

Shews with what difference the Arteries in Various Animals pass through the Skull; also for what use the wonderful Net is made, and the reason of it.

THE Arteries, destinated to the Brain, are four in number, *viz.* two *Carotides*, and as many *Vertebals*. Concerning the former, we have already observed, that their Trunks pass through the Wedge-like Bone, as it were with a mechanical provision; to wit, either Artery is so bowed and intorted in its ascent, that the blood, before it can reach to the Brain by a repeated stopping of shores, or hindered by a certain lett or impediment, might flow to it less rapidly and more slowly. But this is not effected after one and the same manner in all Animals: for although the ascent of the Artery be oblique and intorted in all, yet in some, *viz.* in a Man and a Horse, it being bowed about with a greater compass, still enters, even to the Brain, with a single and undivided Trunk: when in most other beasts the same passes the Skull with a lesser circuit, and sliding presently under the *Dura Mater*, diversifies it self there into Retiform infoldings, commonly called the wonderful Net. Therefore it seems to be to the purpose, that we inquire into the various reasons of this difference.

In the first place therefore we shall advertise you, that the Carotidick Artery in a man enters a little more backward the Skull, than in any other Animal, *viz.* nigh that hole through which the lateral bosom slides out of the Skull about to be implanted into the Jugular Vein; for in the rest, this Artery arises within the Skull under the end or acute process of the stony Bone. But in an humane Head, the same being carried about by a longer compass, (that the Torrent of the blood, before it comes to the border of the Brain, might flow slowly and pleasantly with a broken force) attains to the Basis of the Skull nigh the den made by the ingress of the lateral bosom; where being presently intorted, it enters the proper Chanel insculped in the Wedge-like Bone, and for the greater assurance it is clothed besides with a thicker additional Coat. This double defence seems to be given it, lest the blood, boiling up too much, and whilst it is carried violently towards the head, should make a Whirlpool about the ingress of the Skull, to wit, where it begins to be wreathed about from its direct ascent, and should break by its flood the banks of the Belly, unless they were more firm. The Artery being slid out of the bony chanel, lays aside also its asciticous or additional Coat; and now being well enough defended within the Skull, goes forward clothed only with its proper Coat, and creeps under the *Dura Mater*, and being as it were depressed in the midst of its passage into a valley, being immediately carried out again, it goes on till it comes to the head of the Turkey Chair; where again being bent in and intorted, with a certain compass, it ascends straight, and boring through the *Dura Mater*, is carried towards the Brain. The Trunk of this *Carotis*, like a Meander, passing through the Skull with a very much bending way or passage, is aptly represented in the first Figure of the following Table.

If the reason of this kind of Conformation be inquired into, it easily occurs, that in an humane Head, where the generous Affections, and the great forces and ardors of the Souls are stirred up, the approach of the blood to the confines of the Brain, ought to be free and expeditious; and it is behoveful for its River not to run in narrow and manifoldly divided Rivulets, which would scarce drive a Mill, but always with a broad and open chanel, such as might bear a Ship under Sail. And indeed, in this respect,

respect, a man differs from most brute beasts, in which, the Artery being divided into a thousand little shoots, lest it should carry the blood with a fuller chanel, or more quick course than is requisite, makes the Net-like infoldings, by which indeed it comes to pass, that the blood slides into the Brain very slowly, and with a gentle and almost even stream. If that be true, as some affirm, that the wonderful Net also is sometimes found in an humane Brain, I believe it is only in those sort of men, who being of a slender wit or unmoved disposition, and destitute of all force and ardor of the mind, are little better than dull working beasts in fortitude and wisdom.

Secondly, The conformation of the Carotidick Artery in a Horse, comes nearest its structure in a man; for in this the Artery enters the Skull also lower, and with a greater compass than in other four-footed beasts: which being passed, its Trunk being intorted, with a certain compass, and then a little depressed, goes forward whole to the side of the Turkey Chair still with a full and broad chanel: which truly ought to be made so, because magnanimous and fierce forces are convenient for this Animal, born as it were for War and any dangerous attempts; and so there was need, that the blood might ascend the Brain with a free and plentiful course, and (when occasion requires) with a full Torrent. But though the blood passes through the Basis of a Horses Skull in the same undivided chanel, yet it ought not to come to the Brain it self in one single passage; because the frame or substance of this in a Horse being far weaker and colder than in a man, it might be overthrown and drowned by the blood rushing in by heaps: wherefore the great River of the Artery disburdens it self by two Emissaries, and pours out its *Latex* at so many distinct places of the Brain. Further, as if by this means there were not yet sufficient caution against the Deluge of the Brain, a transverse or cross chanel, as it were a diversion, is formed between the chanel of either Artery; through which the blood, being straitned for room, may go aside, and flow and reflow from one bank or chanel to another, rather than oppress or overflow the Brain. Also besides, certain shoots being sent out from the Trunk of either Artery, are inserted into the pituitary Glandula, the use of which is doubtless to separate certain serosities of the too watry blood, and to lay them up into that Glandula, whereby the rest of the bloody *Latex*, to be carried to the Brain, becomes more pure and free from dregs. By what means the Carotidick Arteries, in the head of a Horse, pass through the Basis of the Skull, is represented in the second Figure of the following Table. I have not yet had the means to inspect the brains of a Lyon or a Monkey; but there is reason to suspect, that in these also the Carotides do pass through the Skull with a single Trunk. In a Sheep, Calf, Hog, yea in a Dog, Fox, Cat, and other four-footed beasts, which I have hitherto opened, this Artery is divaricated into Net-like infoldings, which Vessels, for what causes and for what uses they are so made, we shall now inquire into.

Thirdly therefore, most other four-footed beasts, different from a Man and a Horse, have the wonderful Net adjoyned to the Carotidick Artery. In truth, this is met with in so many, that common Anatomy hath ascribed it to all Animals, and also to man it self. In whom it is found, we observe, that the Artery, about to enter the Skull, is not carried about with so long a compass, but rising up nigh the hinder part of the Turkish Chair, is presently divided into small shoots; yet so, as one little chanel is stretched right out, which the blood quietly running to, passes through without any stay, being carried straight into the Brain: but from the side of this many rivulets are derived on every side, into which the blood impetuously ascending, may be easily diverted. These little rivers are partly ingrafted into the veinous passages of the same, and the Vessels of the other side, and are partly carried into the pituitary Glandula, and partly a compass being fetched, are returned into the former chanel or belly of the Artery. That it is so, besides naked inspection, appears plainly by this Experiment. If below the Skull, an inky liquor be gently and by degrees injected into the Trunk of the *Carotis*, that passing through the strait passage, is carried presently into the Brain, nor does it dye the lateral infolded Vessels with its tincture; but if this liquor be immitted continually and forcibly, presently running into the folds, it will make black the Vessels of the same and of the opposite side, also entering the hither part of the Glandula and its interior substance. If the use of these kind of infoldings of the Vessels, or the wonderful Net be inquired into, I say, that it is made chiefly for these ends: *viz.* First, that the Torrent of the blood being divided into small rivulets, its more rapid course may be so far dull'd or broken, that it may be but leisurely instilled into the Brain. For otherwise in labouring beasts,

who

who go with their heads hanging down, and have but a weak brain, the more free influx of the blood might easily overthrow the fabrick of the Brain, and spoil the animal Spirits. Secondly, the divarication of the *Carotides* into Net-like infoldings, hath another use of no less moment, to wit, that the more watry blood being (as it is its temperament in most Beasts, and especially in those who are fed with herbage) before it be poured upon the Brain, might carry away some part of the superfluous Serum to the pituitary Glandula, and insfil the other part into the branches or shoots of the Veins to be returned towards the Heart. Thirdly and lastly, for as much as the Vessels on either side are mutually inoculated by this means, there is care taken both that the blood may be exactly mixed before it ascends to the Brain, as also that more certain ways may be made for its passage: because, if perchance an obstruction should happen in one side of the wonderful Net, the blood by that infolding being presently carried to the other, may find a passage: for this cause, to wit, that the blood might be the better prevented from any impediment in its passage, the Vessels are not only inoculated under the *Dura Mater* about the wonderful Net, but the Arteries again on either side, do the same thing as soon as they, being knit to the *Pia Mater*, reach the superficies of the Brain, as hath been already shewn. By these sort of ingraftings of the Vessels in the wonderful Net, it comes to pass, that an inky liquor being injected into one of the *Carotides*, and forced upwards, descends by the Trunk of the Artery on the opposite side, as we have elsewhere observed. Some rude draught of the wonderful Net is expressed in the third Figure of the following Table.

The First Figure

Shews the ascent of the Carotidick Artery, and its situation within an humane Skull, before it is carried towards the Brain.

- A. *The Trunk of the Artery ascending towards the Skull.*
- B. *The same, whilst it is included in the bony Chanel, being clothed with an additional Coat.*
- BC. *The incurvature or bending of the Artery, reaching within the bosom of the Skull representing the bending of a double S.*
- D. *The Trunk of the same being carried towards the Brain.*

The Second Figure

Shews the ascent of the Carotidick Arteries, and their situation in a Horses Skull.

- AA. *Either Carotidick Artery ascending towards the Skull.*
- BB. *The Trunk of either, having past the Skull, pressed down as it were into a valley.*
- CC. *The communications of either by cross Branches.*
- DD. *A Branch from either Trunk destinated for the Dura Mater.*
- dddd. *Little shoots on either side sent into the pituitary Glandula or Kernel.*
- EE, FF. *Either Carotidick Artery being divided before it reaches the Brain, and ascending with a double Trunk.*

The Third Figure

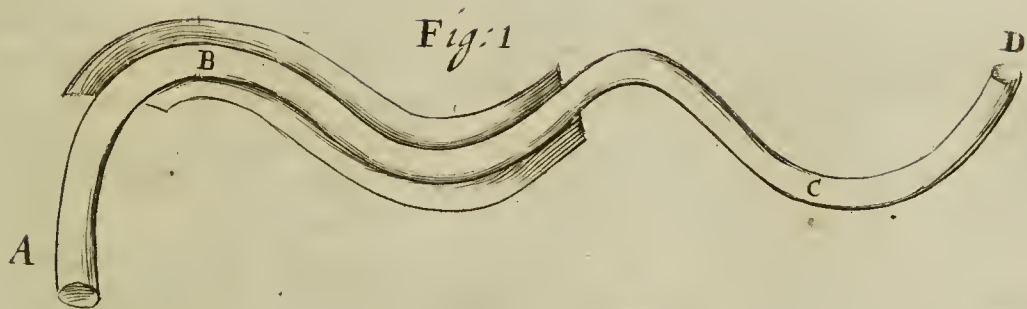
Shews the wonderful Net with the pituitary Kernel in a Calfs Skull.

- A. a. *The direct Chanel of the Artery.*
- B. *The Net-like Infoldings of the Vessels stretched out by that Chanel towards the pituitary Kernel.*
- C. *The pituitary Glandula or Kernel.*

The Fourth Figure

Shews after what manner the lateral Bosom goes into the Jugular Vein with a diverting place hanging to it.

- A. *The lateral Bosom descending.*
- B. *That Bosom sliding into the Skull, and dilating it self into a large and round Cavity, for the receiving of which there is a peculiar Den formed in the outward part of the Skull.*
- C. *The*



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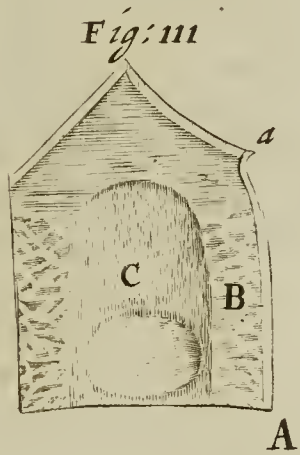
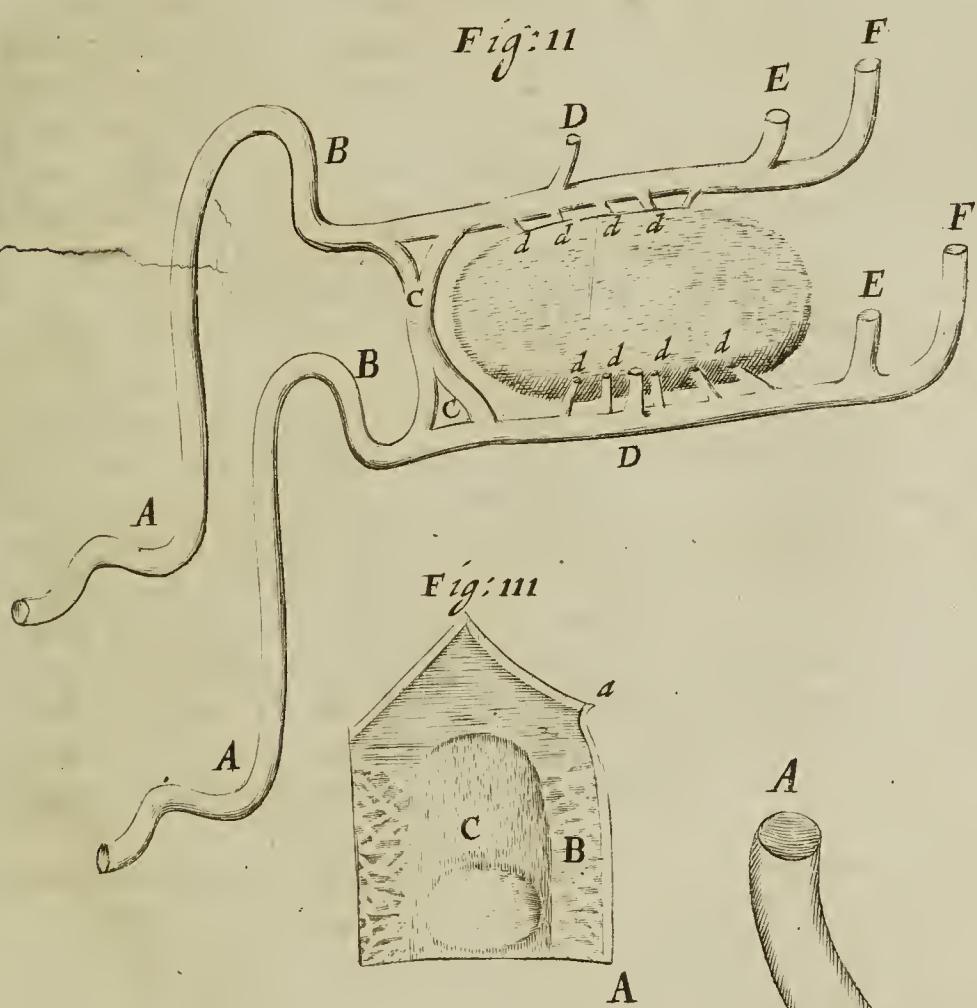
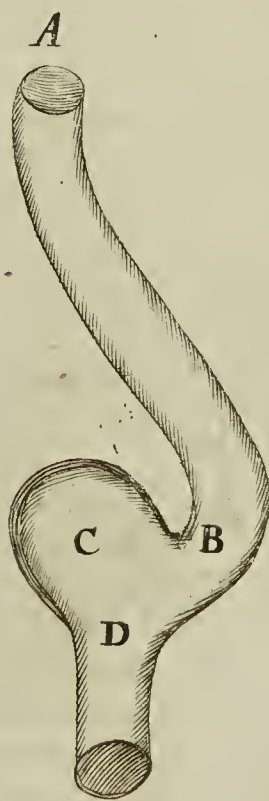


Fig: 1111



C. *The aforeſaid Cavity or diverting place, in which the blood, about to deſcend, may go aſide, leſt it ſhould elſe ruſh too ſtrongly upon the Jugular Vein; by which alſo care is taken, that the blood may not flow back, or regurgitate out of the Jugular Vein into the Boſom.*

D. *The beginning of the Jugular Vein.*

But as the *Carotides* (of whoſe office and aſcent we have hitherto ſpoke) carry the deſtinated Tribute of the blood to the Brain; ſo the *Vertèbrals* ſerve chiefly for the watering the Cerebel and the hinder part of the oblong Marrow. Hence we obſerve, becauſe the conformation of the Cerebel is alike in all Creatures, therefore alſo the *Vertebral Arteries*, different from the *Carotides*, are found alike in all without any great difference. Nor does there ſeem to be need of any great proviſion for the admiſſion or entrance of the *Vertebral Arteries* within the Skull; becauſe, as they carry a leſſer portion of the blood, and for that the blood it ſelf that is to be beſtowed on the Cerebel, is wont there to be agitated or moved with no perturbations of paſſions or conceptions; therefore there is not that neceſſity that there ſhould be placed any remora or any incitement for its Torrent.

The *Vertebral Artery*, ariſing from the branch in the fifth Rib, in its whole aſcent through the hinder part of the Head, paſſes through the little holes cut in the extuberances of the *Vertebrae*, till it comes near the Baſis of the hinder part of the Head; where the ſame being bent down on either ſide, and admitted into the Skull by the laſt hole, excepting where the ſpinal Marrow goes forth, is carried by the ſide of the oblong marrow; but as ſoon as it is brought to the region of the Cerebel, it ſends forth branches on either ſide, which cover its ſuperficies, and beſides on its back ſide make infoldings no leſs ſignal than thoſe commonly called the *Chorooides*, and with larger Kernels more thickly interwoven. As *theſe* ſhoots convey the Juyce requiſite for the ſtilling forth the animal Spirits, ſo *theſe* convey the heated blood and the purified from the ſerous Colluvies. Further, beneath the Cerebel, both the *Vertebral* branches, inclining mutually one to another, are united, as it were for that end, that if the flowing of the blood ſhould be ſtopped on either ſide, it might be ſupplied from the other to the whole compaſs of the Cerebel and its neighbouring parts. Theſe ſanguiferous Veſſels covering the Cerebel, even as the others do the Brain, make ſignal infoldings both in its outward ſuperficies, and in that of the oblong marrow, and alſo within its lappets and folds; from which ſmall ſhoots are ſent forth every where into its under-lying ſubſtance: ſo that from theſe a ſubtil liquor, as it were ſtilled forth and imbibed by the Cortical ſubſtance of the Cerebel, ſeems to go into animal Spirits. By what means, and in what parts of the Head the production of the animal Spirits is performed, remains next to be inquired into.

CH A P. IX.

Shews by what proviſion, and in what places of the Head the Animal Spirits are begotten: Alſo other Uſes and Accidents of the Pia Mater are added.

FROM the deſcription of the Sanguiducts or Blood-carrying Veſſels, which cover and weave about on every ſide the *Pia Mater*, hitherto handled, we are led by a certain thread to conſider by what proviſion, and in what places of the Brain and its Appendix the production of the animal Spirits is performed.

1. As to the firſt, it appears from what hath been already ſaid, that the blood is it ſelf the matter out of which the animal Spirits are drawn; and that the Veſſels containing and carrying it every where through the whole compaſs of the Head, are like diſtillatory Organs, which by circulating more exactly, and as it were ſubliming the blood, ſeparate its purer and more active particles from the reſt, and ſubtilize them, and at length inſinuate thoſe ſpiritualized into the Brain and its Appendix. Concerning this matter to be diſtilled, there is care taken, and indeed by the beſt means, that its ſtock or proviſion may be ſtill ſupplied in fit quality and due quantity.

In respect of the quality, from the whole bloody mass, a portion highly volatile, spirituous, and endued with active Elements, ought constantly to arise towards the Head; which thing succeeds partly of its own accord, and partly that it might be more commodiously done, care is taken with a certain artificialness; to wit, the Vertebral Arteries, in all Creatures ascending straight, and almost perpendicularly, do in a manner cause, that only the more subtil and light blood is carried upwards, the remaining more thick as it were sinking down for the baser offices of the Limbs and of some of the Bowels. Yea, also the *Carotides* in a man, having an erected head higher than the rest of the parts, and in a Horse in some sort lifting up his face, have also the same privilege; to wit, that by their more steep ascent only the more pure and volatile blood may ascend to the region of the Brain. But in other four-footed beasts, who go with a prone or hanging head, and who have a more frigid and watry blood, which may easily slide into, and too much wash the Brain, this evil is in some part prevented by the wonderful Net and pituitary Glandula joyned to the *Carotides*; which indeed receive the superfluous humidities of the blood, and so make it more pure and free from dregs before it comes to the brain.

But that the blood may be supplied still in due quantity, to wit, as it were in weight and measure, from the distillatory Vessels, stretched about the compass of the Head, there is a notable provision made in all the *Carotides* about the Basis of the Skull: because their crooked imbowings and branching into infoldings, hinders the too great or too rapid approach of the blood: then, lest the passage of it should at any time be shut up, the mutual ingraftings of all the Vessels on either side, do help or provide for. After this manner, the business of extracting the animal Spirits is performed even as a Chymical Elixir; to wit, great care is taken in the beginning of that Operation, both that choice of matter may be had, and that only a due proportion of it be exposed to distillation.

The blood by this means, as it were a Chymical work prepared, is carried by the fourfold Chariot of the Arteries to four distinct regions of the Head: and as the sanguiferous Vessels, being distributed with separate ramifications or branches through the whole compass of the Brain and its Appendix, cover all the heights of its compassings about or gyrations, and also all its crevices and their gapings and recesses, they bring to their doors the matter to be distilled into the Head every where through the whole circumference of the Brain and Cerebel nigh the Cortical substance of either; out of which as the Spirits are distilled, by this means it is brought about, that they are insinuated into the subjected substance of either. The blood being carried through the narrow infoldings and divarications of the Vessels, as it were (as was said) through the serpentine chanel of an Alembick is made extremely subtle, as much as may be, in its liquor; in the mean time, what is bloody is received by the little shoots of the Veins associates, or meeting one another every where, and what is ferous by the Kernels every where dispersed; yet its more purified and spirituous part being carried on further through the very small shoots sent forth on all sides, are instilled more deeply into the very Pores and passages of the Brain and Cerebel; which presently flowing from the Cortical substance into the medullary, there exercise the gifts of the animal Function. What peculiar body and constitutive particles of the Brain it self and Cerebel, conduce to the generation and perfection of the animal Spirits within the substance of either, shall be shewn hereafter, when we treat of the Use of those Parts: now shall be taken notice of what we before mentioned, to wit, that the fluid extillation of the spirituous liquor from the blood about the *Pia Mater*, is performed after a signal manner, both from the ambient heat, which is stirred up from the blood contained within the bosoms, as it were from a *Balneo Mariæ*, enriched by the continual flowing of it anew, and also from the obduction of the Meninges, like an Alembick, by which the spirituous Particles, apt to fly away, are constrained and forced into the parts beneath.

But indeed, though the animal Spirits are procreated wholly from the blood, yet the blood watering the Brain and its Appendix, is not only bestowed on this work: for as to the sanguiferous Vessels, which arising out of the Trunks both of the *Carotides* and the *Vertebrals*, cover over the whole Head and all its parts and processes; though many of them, yet not all, are little distillatory chanel of the animal Spirits. For the animal Spirits are not produced in all places, to which these Vessels reach; for we affirm, that these Spirits are only procreated in the Brain and Cerebel: (which it were easie to prove by the Symptoms which happen in the Apoplexy and Palsie, and shall

shall be afterwards clearly shewn) and from this double fountain of the animal Spirits they flow out into all the rest of the parts, and irradiate, by a constant influence, the whole nervous stock. In the mean time, the oblong marrow and its various processes and protuberances are either retreating places, or high roads for the animal Spirits, procreated in the Brain and Cerebel, and flowing from thence. But for as much as the Arteries and Veins clothe these parts also with a thick series of shoots, and that within the infolding of the Brain the folds called *Chorooides* are hung slack and loosely, these seem to be so made for other reasons, viz. both that these parts might be actuated by heat, supplied as it were from a continual fire, and also that the nourishing Juyce might be bestowed on the Spirits which flow there.

As to the first, that the animal Spirits now perfected, may be freely expanded, and irradiate the nervous *System*, there seems to be required, that the ambient heat, being excited by the blood flowing thither, might open all the little spaces for their passage, and notably dilate or lay open for them ways or roads: wherefore we intimated before, because the little shoots of the Vessels ought not to be deeply inserted into the callous body, (for that, lest the commerce of the Spirits, diverting in this Mart or meeting place, should be disturbed by the perpetual influence of the blood) therefore the infolding of the *Chorooides* is hung under its chamber, that at least by this nigh situation, as by a Stove or Hot-house, the heat there might be preserved. Besides, we intimated another use of this infolding; to wit, that the blood, passing through the very narrow *Meanders* and convolutions or rollings about of the Vessels, might lay aside its serous recriments into the Glandula's or passages of the Veins.

2. But secondly, That many branches and lesser shoots of the same Vessels, which water the Brain and Cerebel, cover also the oblong marrow, and in some measure enter into its Pores and deeper substance (within which the animal Spirits are not begotten, but only exercised and expanded) I say, that this is so made for this other respect; to wit, that the substance of the oblong marrow might imbibe a constant provision of nourishment from the pouring in of the blood whereof it hath need. For whilst the animal Spirits, flowing into the nervous stock from the Brain and Cerebel, pass through this passage, as it were the high road, some food he ought to be administered to them, as it were in their journey, from the watering blood: For indeed we suppose (which also will afterwards clearly appear) that the oblong marrow, together with the nervous parts, is moistned with a double humor, viz. one spirituous and highly active, which flows altogether from the Brain and Cerebel, and being from thence derived into the whole nervous stock, bestows upon them the sensitive and moving Faculties; and the other humor softer and more oily and sulphureous, which being supplied from the blood, and affused immediately on every part, is the Author of their Heat and Vegetation. Both these Juyces agree among themselves, and being every where joyned together and married, they are as it were a masculine and feminine seed mixed together; and so they impart to all parts both sense and motion, and all the powers of life and growth. Wherefore it is observed, that all the parts of the whole body, by which motion and sense are performed, do not only swell up with the animal Spirit, of whose influence being deprived, they presently suffer a resolution or loosning; but also they admit the sanguiferous Vessels; of whose Tribute if they be defrauded, presently they wither away, or are distempered with a mortification or Gangrene. Wherefore, that the flesh, membranes, and all the bones may be watered with the blood, (as may be perceived by the help of a Microscope) the very little or minute bodies of some of the Nerves are surrounded with Capillaments or little hairs of Arteries and Veins, together with their proper Fibrils, that we need not doubt to assert, that the Vessels penetrating the superficies of the *Brain* and *Cerebel*, do distil into them a subtil matter for the generation of the animal Spirits; but that some other shoots of the same Vessels, covering the oblong marrow, do only impart to it heat and nourishing Juyce. Lastly, that the infoldings of the *Chorooides* were built under the chamber of the oblong marrow, chiefly for the dispensing of heat, and in some measure for the sake of separation of the serous *Latex*. But concerning these, we shall have occasion to speak more largely afterwards, when we shall treat of the nutritious and nervous Juyce, and when we shall consider of that famous Controversie, viz. whether nourishment is made by the blood or Nerves: further, we shall elsewhere speak more fully of the Nature, Hypostasis, and diverse Disposition of the animal Spirits; also, what the substance of the Brain, and the conformation of the parts, may contribute to their production.

Thus far concerning the *Pia Mater* and the blood-carrying Vessels, which are woven in it, and following its protension, water the whole Head, we have treated largely. But before we quite leave the consideration of this Membrane, we will inquire what sense and motion it may have. Certainly it is not undeservedly that we ascribe the most cruel Head-aches to the more acute sense of this; (in which however, by what means this Meninx is affected, does not so easily appear.) It is the common opinion, that sharp and tormenting Vapours, being raised from the Viscera of the lower Belly, especially from the Ventricle, Hypochondria, or Womb strike against this Membrane, and so pierce it with pain. But we say, though this be impossible, that Vapours passing so many interstices and bars of the Viscera and bones, without any trouble, should ever come to the Head and hurt it: yet we do not deny, but that sometimes vaporous Effluvia's do proceed from the blood boiling or estuating within the confines of the Brain, which being shut up together under the *Pia Mater*, and as it were gathered into a Cloud, do greatly blow up and distend it, and so distemper it with pain. I have often seen, in a Head newly opened after death, the *Pia Mater* distended, and shining like a Bladder, that the same seemed to be intumefied, with much water included under it; which notwithstanding was found to be so done by wind distending the Membrane, for that being dissected, that Tumor fell down without the effusion of water.

But we think the Head-aches, which happen by reason of the evil of this Membrane, are chiefly excited by another means, to wit, for as much as this Meninx suffers a breach of the unity by the blood boiling up above measure, and rushing into its Pores, and so it is contracted into lighter Convulsions. I have sometimes opened the Heads of the defunct, which when living, were obnoxious to most miserable Head-aches; in which, near the longitudinal bosom, where the seat of the pains was, the *Pia Mater* or interior, grew to the *Dura Mater* or exterior for some space, oft-times for two fingers breadth, and by their growing together had excited a sharp and unequal Tumor; in which the mouths of the Vessels were so wholly stopped up, that there was left for the blood, though very much boiling up, no passage into the adjoining bosom.

As to the motion of this Membrane, we wholly deny, that it hath in it self a perpetual Systole and Diastole; however, the Pulses in some Arteries, have seemed something like it, which have given occasion perchance to this vulgar Opinion. Yet in the mean time, it may be lawful to believe, that this Meninx, for that it is very sensible, is rendered obnoxious to Cramps and convulsive motions: and that from its greater contraction the fits of the Falling-sickness do arise, and from its lesser and more partial corrugation or wrinkling together, Head-aches, as hath been said, and also sometimes Scotomies, Vertigoes, and often Convulsions of the Members and Viscera, planted at a great distance from the origine of the Nerves, being drawn into consent.

C H A P. X.

A Description of the Brain, properly so called, and the Explication and Use of its Parts.

WE have thus far beheld the Coverings of the Brain, both the bony and the membranous, also the Arteries and Veins growing and knit to them, like Ivy, and distributed through the whole compass of the Head. There now remains, these coverings being removed, that we next consider the Fabrick and true Hypotype or Character of the Brain and its Appendix, together with the action and use of all the parts. And here at first sight we meet with three things, to wit, the Brain, the oblong Marrow, and the Cerebel: of which the oblong marrow seems to be a common Trunk, to which the Brain and Cerebel grow like branches: wherefore some contend the medullary Rope to be the principal part, and the Brain and Cerebel its dependences. But that it is otherwise appears by this, because these bodies, both in the generation and dispensation of the animal Spirits, are of more noble

noble use than the oblong marrow ; so that if the out-flowings of the Spirits from the Brain or Cerebel be shut up or hindred , the nervous System presently suffers an Eclipse ; in the mean time , if this be primarily distempered , the Brain and Cerebel suffer not for its fault.

That we may begin with the Brain , it may be considered in a double respect ; to wit , both as to its convex or exterior superficies , as it is beheld in its proper site and position ; and as to its interior cavity , to wit , as the Brain appears opened , its concave superficies being expanded and turned upside down. We have already taken care to delineate its true form or Type in either manner , by what hath been before said , to wit , after what manner it is both within and without. There now remains , after its fabrick and conformation being rightly weighed , for us design its offices , and to shew the uses of it and of every one of its parts. Concerning which , we ought to unfold in general , first , what the office of the whole Brain is , then secondly , when we shall descend to particulars , there will come under consideration , 1. The division of the Brain , to wit , its double Hemisphere , also the two Lobes or partitions of either. 2. The narrow cranking turnings and windings , or the gyrations and convolutions or rolling together of the Brain. 3. Its double substance , viz. Cortical and Medullary. 4. The common Basis of all , viz. the callous body. 5. Its subtension or *Fornix*. 6. The appension or circuit of the Brain over or above the oblong marrow. 7. And what results from thence , the void space or Ventricles made by its infolding together. Concerning these , we shall take notice of what things occur worth noting ; concerning the smelling Nerves and their processes , we shall inquire afterwards , when we shall speak particularly of the Nerves.

1. The Brain is accounted the chief seat of the Rational Soul in a man , and of the sensitive in brute beasts , and indeed as the chief mover in the animal Machine , it is the origine and fountain of all motions and conceptions. But some Functions do chiefly and more immediately belong to the substance of this , and others depend as it were mediately and less necessarily upon it. Among these , which of the former sort are accounted the chief , are the Imagination , Memory , and Appetite. For it seems , that the Imagination is a certain undulation or wavering of the animal Spirits , begun more inwardly in the middle of the Brain , and expanded or stretched out from thence on every side towards its circumference : on the contrary , the act of the Memory consists in the regurgitation or flowing back of the Spirits from the exterior compass of the Brain towards its middle. The Appetite is stirred up , for that the animal Spirits , being some-how moved about the middle of the Brain , tend from thence outwardly towards the nervous System. The rest of the Faculties of this Soul , as Sense and Motion , also the Passions and Instincts merely natural , though they depend in some measure upon the Brain , yet they are properly performed in the oblong Marrow and Cerebel , or proceed from them.

2. In some Animals , the substance of the Brain is divided into two parts , as it were Hemispheres , distinct one from another almost through its whole thickness , even to the callous body , which is instead of a bottom ; and in like manner also in all the Sensories , and in most of the other Organs of the necessary Functions , the Brain is as it were twofold , that there might be a provision made against the defect of one side by the supplement of the other. Further , in man , who hath a brain more large and capacious than other Creatures , either Hemisphere is again subdivided into two Lobes , to wit , the Anterior and the Posterior ; between which a branch of the Carotidick Artery , being drawn like a bounding River to both , distinguishes them as it were into two Provinces. Certainly , this second partition of the humane Brain also seems to be designed for its greater safety ; that if perchance any evil should happen to one or both the foremost Lobes , yet the latter , for that they are separated , may avoid the contagion of the neighbouring and farther spreading evil : So the Brain , like a Castle , divided into many Towers or places of Defence , is thereby made the stronger and harder to be taken.

3. Also the universal frame of the Brain appears yet more divided and variegated within all its aforesaid partitions ; for all its whole exterior superficies is made uneven and broken , with turnings and windings and rollings about , almost like those of the Intestines. Those Gyrations or Turnings going from the fore-part of the Brain towards the latter with a creeping compass , and as it were a spiral circuit , encompass both its Hemispheres , that they might mutually furnish all the convolutions with a continued passage : in a more moist Brain , or long kept , the *Pia Mater* , clothing every

every one, and collecting them together, is easily pulled away; and then the turnings or folds being opened and separated one from another, the substance of the brain is seen to be plowed, or laid as it were with furrows; out of which arise banks or ridges of broken crevices, not in a direct series, but cross-wise; so that in the bottom of every furrow, a convolution arising from the right side, is carried to the left, then others following next, being sent from the left side, is drawn to the right, and so by turns the inequalities of the whole brain are variegated in this order.

If it be inquired into, what benefit its Turnings and Convolutions afford to the brain, or for what end its whole anfractuous or broken cranking frame is, we say, that the brain is so framed, both for the more plentiful reception of the spirituous aliment, and also for the more commodious dispensation of the animal Spirits for some uses. As to the aliment to be bestowed on the brain, because it is required to be subtil and extremely wrought or elaborated; therefore it ought to be admitted, not by a more open passage, but only by very small pores and passages. Wherefore that there might be sufficient plenty of spirituous liquor supplied, it is not only drunk in every where in the plain superficies of the brain from its Cortical substance; but that superficies of the brain or Cortical substance is uneven and rough with folds and turnings about; that the spaces for the receiving the Juyce might be enlarged as much as may be: For the anfractuous or cranking brain, like a plot of ground, planted every where with nooks and corners, and danks and mole-hills, hath a far more ample extension, than if its superficies were plain and even. Further, those cranklings of the brain do more fitly hide the sanguiferous Vessels, for that they are very small and slender, and more safely keep them, being variously interwoven into one anothers infoldings, than if they should be openly distributed; for so being carelessly laid, they would be liable to too frequent hurt.

But a reason and necessity of the turnings about in the brain, and not of lesser moment than the other, is fetched from the dispensation of the animal Spirits. For as the animal Spirits, for the various acts of Imagination and Memory, ought to be moved within certain and distinct limited or bounded places, and those motions to be often iterated or repeated through the same tracts or paths: for that reason, these manifold convolutions and infoldings of the brain are required for these divers manners of ordinations of the animal Spirits, to wit, that in these Cells or Store-houses severally placed, might be kept the species of sensible things, and as occasion serves, may be taken from thence. Hence these folds or rollings about are far more and greater in a man than in any other living Creature, to wit, for the various and manifold actings of the superior Faculties; but they are garnished with an uncertain, and as it were fortuitous series, that the exercises of the animal Function might be free and changeable, and not determined to one. Those Gyration or Turnings about in four footed beasts are fewer, and in some, as in a Cat, they are found to be in a certain figure and order: wherefore this Brute thinks on, or remembers scarce any thing but what the instincts and needs of Nature suggest. In the lesser four-footed beasts, also in Fowls and Fishes, the superficies of the brain being plain and even, wants all cranklings and turnings about: wherefore these sort of Animals comprehend or learn by imitation fewer things, and those almost only of one kind; for that in such, distinct Cells, and parted one from another, are wanting, in which the divers Species and Ideas of things are kept apart.

But that in more perfect Animals, all the turnings about are made of a twofold substance, *viz.* Cortical and Medullary; the reason seems to be, that one part may serve for the production of the animal Spirits, and the other for their exercise and dispensation. For we may well think, that the animal Spirits are wholly or for the most part procreated in the Cortical substance of the brain; for this severs and receives immediately from the blood the subtil liquor, and imbuing it with a volatile Salt, exalts it into very pure Spirits. It is obvious to every one, that the Arteries enter the *Cortex* of the brain with a more frequent insertion of shoots, and instil to it a spirituous liquor; the leavings of which, or what is superfluous, the Veins in like manner entring it, do sup up and carry away; in the mean time, the more subtil portion being here set free, goes into Spirits. In truth, the blood waters the medullary substance of the brain in a very small quantity; which seems truly to be rather for the sake of exciting of heat, than that the animal Spirits should there be generated by the flowing in of that blood. For indeed, the volatile Salt, which like Ferment, spiritualizes the subtil liquor stilled forth from the blood, is had more copiously

copiously in the *Cortex* of the brain, rather than in its middle or marrowy part; because that part, being endued with an Ashy colour, shews by its aspect the spermatick Particles and Humor contained in them, in which Spirit and a volatile Salt very much abounds; yea and plainly resembles an Armeniack smell, (such as either part alike breathe forth.) In the mean time, the medullary part of the brain seems very like the oblong marrow and the spinal. But it is well enough known, that these medullary parts serve for the exercise and dispensation of the animal Spirits, and not for their generation. The sign of which is, that where-ever an obstruction happens in them, whatever is below, being destitute of the influx of the Spirits, suffers an Eclipse; whence it follows, that the animal Spirits, irradiating the medullary Rope, are not produced in it, but flow in from elsewhere; and why should not we think the same of the middle marrow of the brain? Truly, that this part is rather the Mart or Exchange of the Spirits than its Shop or Work-house, appears from hence, because the Animals which excel in Memory, Imagination, and Appetite, are furnished with a more ample marrow of the brain; as is observed in man and the more perfect four-footed beasts: and they who seem to have little need of those Faculties, as the lesser four-footed beasts, also Fowls and Fishes have the *Cortex* of the brain greater, but the medullary part very small. It is a familiar Experiment among Boys to thrust a needle through the head of a Hen, and that she in the mean time, whose brain is so pierced through, shall live and be well a long time. The reason of which is, because the whole substance of the brain in these sort of Animals is almost merely Cortical; wherefore from the suffering such a hurt, (as long as the marrow remains unhurt) the Spirits are generated in a lesser quantity, but their commerce to the necessaries of life, are not therefore presently interrupted. Indeed the brains of Birds consist almost wholly of a Cortical and Ashy part; and the medullary part is exceeding small, and is only like a smaller Nerve descending on either side from the substance of the brain it self.

After the animal Spirits are begot by a constant afflux of the blood within the *Cortex* of the Brain, being there begotten, having obtained a watry Vehicle, they flow presently more inwardly, and soon enter into the marrows, filling the furrows and baulks of all the turning and winding Crevices; from whence being carried farther through all the particular tracts of each marrow into the marrowy substance, which lyes under all the winding Crevices, as their common Basis, they are brought at last into the *Callous Body*, as into a spacious field; where, as in a free and open place, these Spirits being newly produced, are expatiated or issue forth.

5. Indeed this medullary substance called the *Callous Body*, which chambering the more inward superficies of the brain, receives into it self the marrow of all the turning Crevices, seems to be made for that end, and disposed there for the same purpose; to wit, that the Spirits flowing into it on every side, might be stretched out as in their proper Sphere, and begin to exercise the acts of the animal Faculties. In this place, they which come out of the several winding Crevices, do meet together, and remain as in a publick *Emporium* or Mart; from whence, as occasion serves, they are raised up, and drawn forth for the uses of every Faculty. But whilst they here remain at leisure and not busied, they become purified or refined more and more by a continual circulation: because these Spirits new-born, do gently and perpetually flow on every side from the outmost bounds of this body (to wit, where this common marrow besmeares the hinder productions of the brain, or the border of either of its Hemispheres) towards the fore-part of this *callous Body*, where it is thickest; and there, if there be need, they are employed on the act of the Imagination, or entering the shanks of the *oblong Marrow*, they actuate and inspire the nervous *Appendix*: but what Spirits are remaining there, after these offices are served, run forthwith into the *Fornix*, and passing through its passage, they are remanded back again to the hinder region of the brain by a certain circulation; and lastly, after this manner, penetrating through the narrow passages of the *Fornix*, those Spirits are made more subtil, and also, as it seems most likely, they perform in this circulary motion those more subtil acts of the Phantasie.

6. Truly, that we may here speak something of the *Fornix*, it seems that this part serves for a twofold use: viz. first, lest the more inward sides of the Brain hanging slack and loosely, might fall together among themselves, or might be removed beyond the limits of a just protension or out-stretching; for they, not only by the coming between of the *Pia Mater*, and by little cords drawn from it, cohere to

the

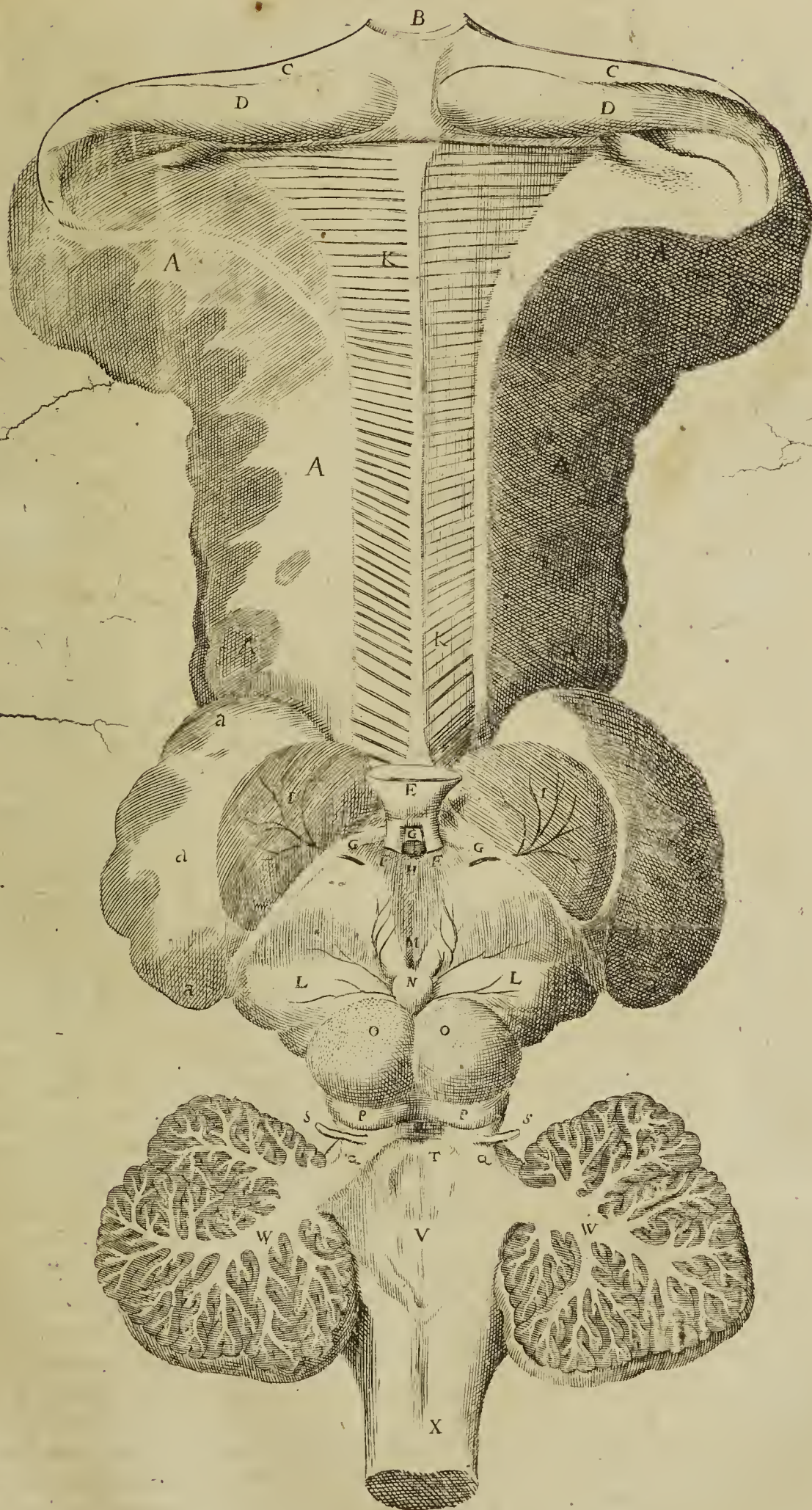
the oblong marrow and the Cerebel; but besides, the *Fornix*, like a Ligament or string brought from one end of the brain to the other, constrains and keeps its whole frame in its due figure and situation. For this part purely medullar, and of the same substance with the callous Body, seems to be a certain process of this, which arising more forward between the streaked bodies, and falling upon the two shanks of the oblong marrow, first of all distinguishes them; afterwards, being separated from them, is carried through the midst of the cavity, and about the hinder part of the brain is divided as it were into two Arms, which being bent on both sides, and again cleaving to the border of the *callous Body*, strictly embrace the oblong marrow, and knit and firmly tie the hinder bulk of the brain to its Trunk, lest it should flow or slide forth. But the other, and that the more noted use of the *Fornix* seems to be what we but now mentioned; to wit, that the animal Spirits may immediately pass through its passage from one end of the brain to the other, and so, as it were through the bill of a *Pelican*, they might be circulated into their own intorted belly.

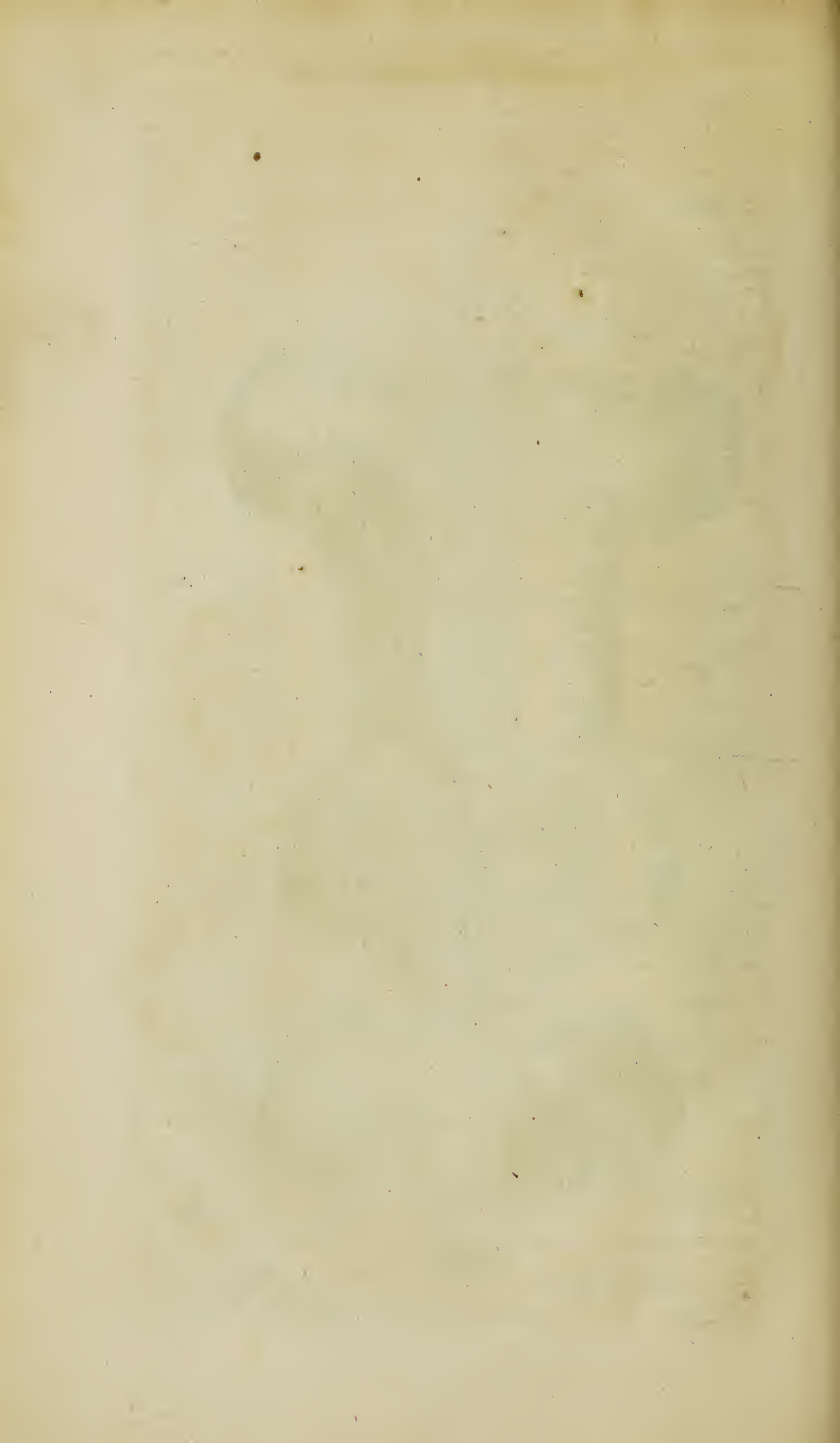
That those things which were but now declared concerning the *Penetralia* and inward recesses of the Brain, may be the better understood, we will here add a Scheme of its Sphere turned inside out, and stretched out as it were upon a plain, so that the concave and inmost superficies of the *callous Body*, together with the *Fornix*, may be sufficiently seen.

The Seventh Figure

Shews the Brain of a Sheep bent back and cut a little open in the places where they stick together near the streaked bodies, that its interior substance may be turned the inside out, and unfolded on a plain.

- AA. The substance of the Brain cut asunder, which in its natural situation being folded together, did cohere with the rest of its substance a. a. upon the remaining streaked Bodies.
- B. The Trunk of the Fornix, or Psaloides cut asunder, which in its natural site coheres with the Basis of the same Fornix E.
- CC. The Arms of the Fornix which embrace the medullary Trunk on the other side of the Pineal Glandula.
- DD. The brim of the callous Body which embraces the medullary Trunk near the Cerebel.
- E. The Basis of the Fornix.
- FF. Two straight Roots of the Fornix lying between the streaked Bodies.
- GG. The transverse medullary Process knitting the two streaked Bodies one to another.
- H. The Chink near the Roots of the Fornix leading to the Tunnel.
- II. The streaked Bodies, whose Superficies the small Arteries and Veins cover over.
- KK. The interior Superficies of the callous Body marked with transverse medullary streaks or chamferatings, or reaching from one Hemisphere of the Brain to the other.
- LL. The Chambers or hollow places of the Optick Nerves.
- M. The anterior hole leading to the Ventricle lying under the orbicular Protuberances, which also goes slope-wise to the Tunnel.
- N. The Pineal Glandula which appears more plain, the Pia Mater and the Choroeidal infolding being separated and removed.
- OO. The Natiform or Buttock-like Protuberances, which are here far greater than in a Man or a Dog.
- PP. The lesser Protuberances called Testes, which are additions or things growing out of the former.
- QQ. The medullary Processes stretching from the Testes into the middle or marrowy part of the Cerebel.
- R. The meeting together of those Processes.
- SS. The Pathetick Nerves of the Eyes arising out of the meeting together of those Processes.
- T. The posterior hole leading into the Ventricle, lying under the orbicular Protuberances, and also into the same opening of the Tunnel.
- V. A Furrow in the medullary Trunk, which being covered by the Cerebel, makes the fourth Ventricle.
- WW. The Ramifications or Branchings of the medullary substance of the Cerebel, which appear like a Tree.
- X. The end of the oblong Marrow about to go into the Spinal.





C H A P. XI.

Shews with what motion and tendency of the Animal Spirits the Exercises of the Animal Faculties are performed within the Confines of the Brain : Also what the use of its Ventricles is.

Hitherto setting forth the uses and offices of the Brain, properly so called, and of its parts, we have shewed after what manner the animal Spirits are produced from the blood in this their principal Shop or Work-house; and into what diverting places, they being newly brought forth, do depart of themselves, and are there kept as it were in distinct Cloisters or Cells to be drawn forth for the manifold Exercises of the animal Function. But because these Spirits, so brought to perfection, and ready for their work within the same parts of the Brain, enter into other manner of motions, and divers ways of emanations; therefore before we proceed any further, for the searching out their tracts within the oblong Marrow and Cerebel, we ought to declare concerning these Spirits disposed within the confines of the Brain it self, with what forces they are furnished, in what form they unfold themselves, and in what ways they diffuse themselves and go forward as often as being mustered in due order, they produce the acts of the Imagination, Memory, Appetite, and other superior Faculties of the Soul. But for as much as hereafter, when we have finished the explication of the Head and nervous Appendix, we have resolved, for a conclusion, to treat of the Soul of Brutes and its powers, I may therefore for the present lay aside this task; unless that in the mean time it may not seem amiss to give a taste only in general of these few things: *viz.* as there are two parts of the inferior Soul, or of Beasts, to wit, the vital or flamy, being inkindled in the blood, and the sensitive or lucid, being diffused through the whole Head and its nervous dependences, the animal Spirits being continually produced in the Brain and in the Cerebel, do constitute a double as it were Root or Fountain of this lucid part: yea, the Spirits of either lineage, for as much as they are continued both within those Fountains, and from thence through the frame or substance of the nervous System, as it were under the same beamy *Systasis* and contexture, they effect or cause the whole *Hypostasis* or subsistency of the sensitive Soul.

But there happen to this Soul, because it is apt to be moved with a various impulse, and so to contract or dilate its species in the whole, or in part, for that reason divers manners both of Actions and of Passions, to wit, the Senses, which we call its Passions; and Motions, which we name the Actions of the same. The formal reason of the former, *viz.* the Senses, consists in the retraction or drawing back of the Spirits, or a flowing back towards their Fountains. For where-ever the impression of a sensible object is carried to this radiant or beamy contexture, presently either the whole frame, or some portion of it, whereby it admits the species, is compelled to wag, and to be moved back, as it were to leap back and recede into it self: on the contrary, the actions or motions of this Soul are made, for that this shadowy Spirit, being incited or stirred up in the whole, or in a certain part, unfolds it self more largely, and by an emanation, and as it were a certain vibration of the Spirits, exerts or puts forth its virtue and force of acting.

Both the Senses and Motions of this sensitive Soul are made either transient, when the Spirits, or its constitutive Particles, being moved somewhere in the System of the Nerves, draw together with them the containing parts, and deflect them with the like carriage or gesture with themselves, as is observed in the five outward Senses, and the local motions of the Members: or else, either both Actions and Passions are continuing, to wit, when both the Motions and Senses are silently performed without any great agitation or moving of the body, or its parts, within the first Fountains of the Soul, *viz.* the Head it self. These kind of Passions indeed, made within the substance of the Brain, are the common Sense and Imagination; but the Actions are Memory, Phantasie, and Appetite: and either of these, as to their beginnings and instincts, depend for the most part upon the outward Senses.

Concerning the former, we take notice, that as often as the exterior part of the

Soul being struck, a sensible impression, as it were the Optick Species, or as an undulation or waving of waters, is carried more inward, bending towards the chamfered bodies, a perception or inward sense of the Sensation outwardly had or received, arises. If that this impression, being carried farther, passes through the *callous Body*, Imagination follows the Sense: Then if the same fluctuation of Spirits is struck against the *Cortex* of the Brain, as its utmost banks, it impresses on it the image or character of the sensible Object, which, when it is afterwards reflected or bent back, raises up the Memory of the same thing.

The active Powers of this Soul, *viz.* Local Motion, Memory, Phantasie, and Appetite follow sometimes immediately the Passions, sometimes are induced apart from them upon other occasions. For indeed the sensible impression striking the streaked or chamfered bodies, oftentimes, the Brain being in no wise affected, causes the local Motions to be retorted with a reciprocal tendency of the animal Spirits; so in sleep (the Appetite knowing nothing of it) when pain troubles, presently we rub the place, moving the hand to it: but more often, after that the sensible Species, having past from the common Sensory to the *callous Body*, hath stirred up the Imagination, the Spirits, reflecting from thence, and flowing back towards the nervous Appendix, raise up the Appetite and Local Motions, the Executors or Performers of the same: And sometimes a certain sensible impression, being carried beyond the callous Body, and striking against the *Cortex* of the Brain it self, raises up other species lying hid there, and so induces Memory with Phantasie, also often with Appetite and Local Motion associates. Further, these active Powers, sometimes upon other occasions, are wont to be stirred up and exercised apart from Passion. In Man, the Rational Soul variously moves the sensitive, and at its pleasure draws forth and brings into act its Powers, sometimes these, sometimes those. Moreover, the blood boiling up above measure, and by that means striking impetuously the border of the Brain, excites the species of things lurking in it, and driving them forward towards the middle or marrowy part of the Brain, causes also the various Acts of the Phantasie and Memory to be represented.

Concerning the aforesaid interior or abiding Faculties, we shall at present further take notice, that their more perfect Exercises are chiefly and almost only performed by the Spirits already perfected and highly elaborated; for those a making, or that are new made, being numerous, they very much obstruct and hinder the acts of the animal Function: to wit, when from the Vessels, on every side watering the *Cortex* of the Brain, the subtil Liquor is plentifully instilled for the matter of the animal Spirits, this flowing inwardly stuffs all the pores and passages of the Brain, and so excludes for that time the Spirits from their wonted tracts and orbs of expansion. Wherefore whilst the chief reflection of the Brain and Spirits is celebrated, sleep, or an Eclipse of the animal Spirits happens; then waking returns, when from the Liquor instilled, the more subtil part is exalted into very pure Spirits, and at length the more watry, being partly resolved into Vapours, is exhaled, and partly supped up by the passages of the Veins entering the substance of the Brain, or else is sweat out into the vacuity lying under the callous Body. Concerning these I hope we may discourse more largely afterwards. In the mean time, that we may proceed to the rest of the things proposed, concerning the frame of the Brain, properly so called, there yet remains that we speak of its Ventricles: But since they are only a vacuity resulting from the folding up of its exterior border, I see no reason we have to discourse much of their office, no more than Astronomers are wont of the empty space contained within the vacuity of the Sphere.

But in truth, as there is nothing met with in Nature that is not destinated to some use, surely we suspect this same *Vacuum* or empty space not to be built in vain within the Globe of the Brain. The Ancients have so magnified this Cavern, that they affirmed it the Shop of the animal Spirits, both where they themselves were procreated, and performed the chief works of the animal Function. But on the other side, the Moderns or those of later days have esteemed these places so vile, that they have affirmed the same to be mere sinks for the carrying out the excrementitious matter. But indeed that opinion of the Ancients is easily overthrown, for that the animal Spirits, being very subtil, and apt to fly away, require not such large and open spaces, rather than the more narrow passages and little pores, such as are made in the substance of the Brain: for these Spirits (because they ought, for the various Faculties of the Soul, to be composed into various series, and divers orders and dispositions, therefore) ought

ought to be moved within peculiar orbs and tracts. Further, if any one shall exactly consider the fabrick of the Brain, and seriously weigh, that these Ventricles are not formed out of the primary intention of Nature, but result only secondarily and accidentally from the complication of the Brain, he will be far from thinking, that the supreme seat of the Soul is fixed there, where being hem'd in with a most noble Guard of Spirits, it doth execute and perform its Functions. For it neither appears at all out of what matter, and by what artifice the Spirits are there begotten, nor by what ways of emanation they are derived from thence into the other parts of the Brain and nervous System. Wherefore almost all Anatomists, who are of a later Age, have attributed that vile office of a Jakes or sink to this more inward chamber of the Brain. To which Opinion there has been some trust given, for that these Ventricles are often seen in the dead to be filled with water; also from these, ways seem to lye open for excretion, both towards the Tunnel, and also into the Sieve-like Bone. It is observed, that where-ever the blood flows more copiously into any part, and waters it, there Vapors or watry Humors are begotten from the superfluous Serum left in the circulation, which for the most part either exhale out through vaporous Effluvia's, or are brought back into the blood by the Veins or Lymphatick Vessels. But when the blood; by a plentiful influx, waters not only the *Cortex* of the Brain, but the interior marrow also, it remains, that the serous *Latex* (when-ever it abounds more in the blood, than that its superfluities may be reduced immediately by the Veins, or by the Lymphæducts, if they be there, or may be separated by the Glandula's) should slide down into this den, made hollow within the infolding of the Brain. Truly there are many instances, which plainly evince, that the serous humors are ordinarily laid up in the Ventricles of the Brain. Anatomical Observations of men dying of many Cephalick diseases, and especially of soporiferous or sleepy distempers, confirm this. Yea, it may be lawfully thought, that natural sleep follows, for that the Pores and passages of the Brain are occupied and stuffed with a watry *Latex*, which serves for a Vehicle to the Spirits. Then as often as a profound sleep invades any one from a Surfeit, or drinking of Wine, the cause is, that the little spaces in the medullary substance of the Brain, destinated for the motions of the Spirits, are too much obstructed by a Narcotick or a watry humor: certain reliques of which, being resolved into vapor, and thrust out from the company of the Spirits, do often sweat out, or drop into this *Vacuum* or empty space.

After this manner, it may be believed concerning the Ventricles of the Brain, or the empty space left within its plicature or folding together. But in truth, because this matter hath been very much controverted among Physicians of every Age, and the right decision of it seems to be of great moment, for the explicating the offices of the other parts of the Head; I will here compare together the reasons for and against this Opinion, that we may at length give our Judgment of this Opinion, what may be either true, or most likely.

C H A P. XII.

It is inquired into, whether the serous Humors, heaped together within the Vacuity of the Brain, be sent out by the Pituitary Glandula and the Sieve-like Bone, or not?

Since Experience testifies, that the Serum and excrementitious, I may justly say morbidick, and oftentimes deadly Humors, are found frequently within these Ventricles of the Brain; we ought to inquire more diligently concerning their passage in and out: and the rather, for that it is very much doubted by some concerning the use of these Dens, nor are there wanting those in this late Age, who have endeavoured to bring into vogue the ancient Opinion, though long since exploded, concerning the Spirits being begot in this place, and here exercised. I believe without doubting, for the reasons before alledged, that the Spirits are not here begotten, nor exercised: and no less certain is it made by Experience, that the serous Colluvies is here often gathered together. This therefore only remains, that we should see

from whence, and how this flows hither, and then by what ways of Excretion the same should be carried out.

As to the first, it is exceeding probable, that the serous *Latex*, which is the Vehicle of the Spirits newly produced, and is introduced together with them into the Pores of the Brain, after it is grown stale, and being attenuated into Vapour, doth distil forth into this Cavern, and there at last grows into a watry Humor: for otherwise what becomes of that Humor, or into what other Receptacle could it be derived? Besides this ordinary, and I believe assiduous heaping together of the serous Colluvies within the Ventricles of the Brain, certainly it may be believed, that this kind of serous Humor is distilled out of the Glandula's inserted in the *Chorooidal* infolding, being too much filled, into the Ventricles so called. I have often seen in a Dropsie the Glandula's of the Brain to be intumefied, and like grains of Barley, bursting with too much wet, to become flaccid or withered, so that they could not retain the serosities brought to them, but continually disposed them into the Cavity beneath. Truly in a Dropsie of the Brain these Cavities or Ventricles are always seen to be full of water; the cause of which kind of distemper is, the blood being made more watry, puts off in its circulation a greater heap of Serum than the Veins can presently carry back, or the Glandula's are able to receive and retain. For indeed, that the Serum, redounding on every side from the Vessels, may the better slide into the Ventricles of the Brain, it is so ordered, that the greater infoldings of the Vessels, with the inserted Glandula's, should be disposed near all the Ventricles of the Head: because, not only the infolding *Chorooides* is placed nigh the concourse of the three Ventricles in the Brain, but another infolding, and no less noted, (which we above described) with greater Glandula's, is set behind the Cerebel nigh the fourth Ventricle. In all, as it seems, for that end such care is taken, that the watry part, coming from the blood, which is destinated either for the Brain or the Cerebel, for that it is not fit for the procreating of Spirits, might run into these infoldings of the Vessels. But yet if a greater plenty of Serum be there laid up, than can be contained in them, or may be sent away outwardly, whatever is superfluous will slide into the Cavity underneath.

Hence it appears, from whence, and by what means the serous heap is gathered together within the Ventricles of the Brain: certainly to deny this going out is no other than to assert every ones Brain big with a Viper, which cannot be brought forth but by gnawing asunder the bowels of its parent. Who shall lightly consider the parts nigh the Ventricles, and their Fabricks, at first sight only would swear with the Ancients, that the excrements of the brain were laid aside both lower through the Tunnel into the Palate, and above or more forward through the mammillary Processes into the Nostrils: But if the structure of these parts be a little more diligently searched into, there is no body who presently will not easily think, that by neither of these ways the excretion of any humor can be made; for neither from the pituitary Glandula through the Wedge-like bone, nor from the mammillary Processes through the holes of the Sieve-like bone, is there any manifest aperture or opening to be perceived. But in very truth, we do suppose that the brain is in some measure purged by both these Emunctories, for that objection may be answered, That the translations of Humors in living Creatures are easily performed through places that seem impervious or unpassable; for while the Pores and passages in all the parts of a living Creature are dilated by spirit and heat, they transmit the rain of the Serum as through the fine texture of a woollen Cloth. This plainly appears from Arthritick distempers, in which the serous *Latex* creeps by degrees through the nervous bodies, and passing through very small spaces, makes a falling down of humors sometimes upon these parts, and sometimes upon others; so that it is obvious, that the Membranes and nervous Processes drink in the serous humors like Sponges, and then by a light compression render them by heaps, as is manifest in the Tooth-ach; for as often as a Bodkin or Instrument is put up into a hollow Tooth, clear water will come out plentifully. Indeed, in the body of a living Creature the passages of humors are not only made through open passages and chanel; but the thinner and more watry *Latex* creeps through the solid and smooth bodies of the Nerves, as also the Fibres and the Membranes, as through the holes of a Filtre, and so is transferred through imperceptible straits from place to place. I sometime knew in the Impostume of the Lungs the humor to have been derived through the Membranes growing to the *Pleura* from the bag into an Issue made in the side, and so the spitting ceasing, the disease that seemed otherwise

otherwise incurable, was healed by such a way of Evacuation. Why in like manner may we not suppose the serous humors falling down from the Ventricles of the Brain into the pituitary Glandula, and the mammillary Processes to be carried away through the Nerves or Membranes passing through here or there?

Concerning the Tunnel, the thing is probable enough; because the position and structure of this seem to shew, that some humor is carried out of the Ventricles of the Brain towards the pituitary Glandula. For this part is so constituted, that a falling down of the humors may be made from every angle and recess of the interior Brain and its Appendix into its aperture or opening. And as in several Animals, the figure and site of the Ventricles vary very much, (as we have already shewn) yet in every one of them all the Ventricles of the Head, whatsoever they be, have their openings gaping towards the Tunnel. But that this Kernel or Glandula, to which the passage of the Tunnel is inserted, receives and carries out the serous humors, seems also to appear from hence; because it admits, not only those falling from the brain into its Pores, but also those secreted from the blood ascending into the brain: For that in many four-footed beasts, certain Vessels are inserted to this Glandula from either Carotidick Artery, which intimately enters its substance: a sign of which is, that Ink being injected into the Trunk of either Artery, dyes with a black colour the wonderful Net, if it be there, and oftner the interior substance of this Glandula: whence it may be argued, that the office of this Glandula is to receive the superfluous serosities; and it receives not only those sent away in the return from the brain, but sometimes preoccupies or prevents them, and is wont to derive them from the blood before it is carried to the brain. And therefore this Glandula is very small, if the superfluities of the Serum be derived to it only from the brain; but greater, if they come to it also from the blood, to wit, as it executes either one or a double office, as we have already shewn at large.

But as to what respects the way of passing through, to wit, by which the humors, deposited in this Glandula, are carried out, the vulgar Opinion is, that they do come away through the holes of the bone beneath into the Palate: wherefore in those kind of Animals, who have the wonderful Net, and many of its shoots enter this Glandula, more holes are made in the underlying bone. Further, if you take away the ditch or gutter of the Wedge-like bone, or the seat of this Glandula, cut off from the Skull, and pour water upon its holes being made bare from the Membrane, it passing presently through the substance of the whole bone, will suddenly still forth through other holes lying open in the sides of the bone. Yet this Experiment concludes nothing for the Opinion proposed: because these holes are wholly wanting in some Creatures; and very much in an humane Skull; in those who have them, as in a Calf, especially it is observed, that the same are filled by some hollow Vessels; into which if a black liquor be cast by a Syringe, that passing through the substance of the bone, will go into many other Vessels lying under the bone, and at length into the Trunk of the Jugular Vein; which certainly is a sign that the humors are not carried from hence into the Palate. But as to the Vessels which cover over the holes of the bone, and which more abundantly lye under the same, they seem to be either Veins or Lymphæducts.

But among these it is lawful to conjecture, the chief means of Excretion, whereby the serous humors, laid up in the pituitary Kernel, may be carried out; to wit, that they are remanded back from it, as from most other Glandula's or Kernels, into the mass of blood. In a Calf the thing lies open to ocular inspection, nor is it to be doubted of other Animals, who have the admirable Net: because, as the arterious branches, so also the veinous reach to this Glandula; which sup up not only the humors deposited from the Arteries, but also those falling from the Ventricles of the Brain. Yea, it may be lawfully believed, that in a Man also, a Horse, and in other Creatures, who want the strange or wonderful Net, there are other Lymphæducts or Water-carriers, or some such kind of Vessels, as are seen in the head of a Calf, that most certainly carry the humors from this Glandula. We cannot so easily find out their footsteps, because, before these break out of their dens, the tracts of the Lymphæducts, if there be any, would vanish. Nor can we find out these Vessels in all, as in a Calf, by injection; because the holes of the bone, by which, as by the leading of a thread, the injection arrives at, and dyes the Vessels, otherwise lying hid, are wanting in most. No doubt but time will render sufficiently manifest the reductions of the humors from the pituitary Glandula in other living Creatures: in
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the mean time, it may be lawfully suspected, for that the ferocities in some are remanded from thence into the bloody mass, that in all it is done after the like or the same manner, although the ways of the passing do not yet sufficiently lye open.

As to the other Emunctory of the Brain, to wit, whereby the ferous humors, laid aside from the Ventricles of the Brain into the mammillary Processes, and thence are thought to be sent away through the holes of the Sieve-like bone: truly, concerning this way of Excretion, it is much more to be doubted, because these holes in the defunct being covered over and fully stufft, with the insertions of the *Dura Mater* and nervous Fibres, sent on either side from the mammillary Process, transmit nothing of humor, how clear soever it be. Further, there is nothing more certain, than that the ferous humors are pressed out from the Glandula's and extremities of the Vessels ending within the Nostrils into their Caverns; so besides that 'tis scarce possible for the humors to descend thither from the brain, it is not absolutely needful to suppose this sort of means of Excretion. But that we may reason a little farther concerning these; if it may be lawful to argue from the provision, and from the effects of the parts, there is no reason but that I may probably believe, that some humors also do shower down from the Brain into the cavities of the Nostrils: for it being supposed, that the ferous humor passes through, not only open chanel, but the more strict Pores and passages also of the Nerves, and creeping both through the Fibres and Membranes, as through the straining or holes of a Filter or Strainer, is carried from place to place, (which it were easie to demonstrate) what should hinder but that the same sort of *Latex* may descend through the Fibres impacted in the holes of the straining bone? For although in dead Creatures those parts seem to be impervious or unpassable, yet during the life of the Animal the passages and blind ways of the nervous bodies, being dilated by Spirit and Heat, most easily transmit a copious humor wherewith they are watered.

The Sieve-like Bone in divers Animals is variously perforated for the manifold necessity and difference of smelling. A Process from the *Dura Mater* and manifold nervous Fibres pass through every one of its holes, and besmear the inside of the Nostrils. But as the impressions of sensible things, or sensible Species, continued as it were by the undulation or waving of the animal Spirits, ascend through the passages of these bodies stretched out from the Organ towards the Sensory; so the humidities watering the same bodies, for as much as sometimes they may be more superfluous than usual, may distil into the Nostrils through the same ways. For indeed such humors as are perpetually to be sent away from the brain, ought so copiously to be poured upon the Organs of Smelling, as we shall shew hereafter, when we shall speak particularly of the smelling Nerves; in the mean time, that there is such a way of Excretion opening into the Nostrils, some observations, taken of sick people troubled with Cephalick diseases, do further perswade. I have known some very obnoxious to the Scotomy and Vertiginous distempers, who had great plenty of clear water that distilled forth about the end of the Fit; by which kind of Evacuation, as it were Critical, the Fit was wont to be ended. Not long since, a Virgin living in this City, was afflicted a long time with a most cruel Head-ach, and in the midst of her pain much and thin yellow Serum daily flowed out from her Nostrils: the last Winter this Excretion stopped for some time, and then the sick party growing worse in her Head, fell into cruel Convulsions, with a stupidity; and within three days dyed Apoplectical. Her Head being opened, that kind of yellow *Latex* overflowed the deeper turnings and windings of the Brain and its interior Cavity or Ventricles. I knew a Gentlewoman that was wont to be infested with a most cruel Head-ach, also with a Vertigo, and a frequent melting of the animal Spirits, or Swooning away; who when she began to be better, after a grievous Fit, felt at first a creeping motion in the top of her Brain, as it were the sliding down of water: then that motion passing a little more forwards and downwards, at length many drops of clear water distilled from her Nostrils. This Symptom she used to have so ordinarily, that the sick Gentlewoman did not doubt but that this water stilled out from the brain it self. I could here bring many other reasons, which might seem to perswade, that the Ventricles of the Brain, or the Cavity made by the complicature or folding up of its border, is a mere sink of the excrementitious Humor; and that the humors there congested, are purged out by the Nose and Palate: But it is time for us to hasten to other matters, and to pass from the Brain, properly so called, to its Appendix, viz. the oblong Marrow and the Cerebel.

C H A P. XIII.

The Actions and Uses of the oblong Marrow, and of some of its Parts are unfolded.

WE will pass now from the Brain to the explication of its Trunk, to which both it and the Cerebel do grow like Mushrooms or large Excrescences. This part is commonly called the Oblong Marrow; under which name we comprehend all that substance which reaches from the inmost Cavity of the callous Body, and conjuncture in the Basis of the Head, to the hole of the hinder part of the Head; where the same substance, being yet farther continued, ends in the spinal Marrow.

The superficies of the oblong Marrow, though it be made unequal with some protuberances and processes, yet it is not variegated or garnished with any turnings about, and involutions, as it is in the Brain and Cerebel; neither is its exterior and cortical substance, or of an Ash-colour, and the interior, medullar or marrowy and white; but all its frame or substance is in a sort marrowy or medullous: nor does it however appear pure and bright, but much darkened with fibres and hairs variously stretched forth, and diversly going out. To wit, its fibres being figured in various places, after a diverse manner, in some places they are found chamfered, and as it were beamy, in others direct or stretched out at length, and in other places again circular.

The figure of this is forked, and as it were like the Poets *Parnassus*, seems like the letter Y: for its shanks arising more forward from either Hemisphere of the Brain, and inclining one to another, grow together near the centre of the Skull into one and the same Trunk; which notwithstanding, a line being brought through the midst, seems to be made as it were out of two stalks, and those to be distinguished in its whole process.

The oblong Marrow seems to be a broad or high Road, into which the animal Spirits perpetually flow from their double Fountain, to wit, the Brain and the Cerebel, to be derived from thence into all the nervous parts of the whole Body: which Spirits, whilst they are orderly disposed in this common passage, as it were by series and orders, carry a twofold aspect; to wit, they are directed either outward towards the Nerves, when they exert the loco-motive Faculty, or they look inward towards their Fountains, when the acts of sense, or rather the apprehensions of sensible things are performed.

Within this open way, a more large and greatly open path leads straight to the spinal Marrow, through which the Spirits flow forth to the Nerves, the Executors of spontaneous Motion in most members. In the meantime, out of the same tract of the oblong Marrow, lesser paths are carried outwardly, here and there, by particular Nerves, arising from the same, within the Skull. Also besides, many diverting places, viz. various processes and protuberances grow to this medullary Trunk, into which, the Spirits destined to some peculiar offices, go apart: lest that all the Spirits travelling this way and that way in the same path, should meet one another and disturb one anothers offices.

Whilst after this manner, for the performing the acts of Motion and Sense, we suppose the animal Spirits to be expatiated within the oblong Marrow; we affirm, that they are not there begotten, but only exercised. For indeed, they being created only in the Brain and Cerebel, as they proceed from this or that, they perform the offices, either of a merely involuntary Function, or else of a spontaneous, as shall be shewed more largely hereafter.

But that we may unfold here all things which belong to the oblong Marrow, I shall mete it forth from its first coming out to the end of its race, and handle its several *Stadia*, diverting places, and cross ways. Where the callous Body is thought to end, the oblong Marrow begins; to wit, when the medullar substance of the Brain is thickest nigh the bosses or knobs of either Hemisphere, a body of a whitish colour and somewhat darkned or obscured, and streaked like Ivory, is joyned to that marrow on both sides. These two bodies are the extremities or tops of the shanks of the oblong

long Marrow; between which and the Brain there are nigh and very immediate commerces. Either of these seems as it were a Cylinder rolled about into an Orb, which nevertheless constitutes the top of either shank, not spherical, but oval, and something bent downward in the hinder part. A more large portion of its superficies is joyned to the medullar substance of the Brain; but yet some part of it, being free from the cohesion with the Brain, shews it self apart, and makes that protuberance shewing it self in either lateral Ventricle. These bodies, if they should be dissected along through the middle, appear marked, with medullar streaks, as it were rays or beams: which sort of chamferings or streaks have a double aspect or tendency; to wit, some descend from the top of this body, as if they were tracts from the Brain into the oblong Marrow; and others ascend from the lower part, and meet the aforesaid, as if they were paths of the Spirits from the oblong Marrow into the Brain. And it is worth observation, that in the whole Head besides there is no part found chamfered or streaked after the like manner.

If the use of these be inquired into, this presently occurs, that these bodies, placed between the Brain and its Appendix, are the great and common diverting places of either; to wit, which receive whatsoever impulses or forces of the animal Spirits are sent from either, and communicate them presently to the other: Or that I may speak more plainly, this part is the common Sensory, to wit, as *Aristotle* saith, τὸ πρῶτον αἰσθητικόν, the first Sensory that receives the strokes of all sensible things, dilated from the Nerves of every Organ, and so causes the perception of every sense; which kind of strokes of sensible things, when from hence they are passed further into the Brain, presently Imagination succeeds the Sense: and further, these bodies, as they receive the forces of all the Senses, so also the first instincts of spontaneous local motions. To wit, as often as the Appetite discerns any thing to be done, presently the reciprocal tendencies of the animal Spirits, that is, from the Brain into these parts, are disposed here to act the conceptions of motions coming from any part or member. For here, as in a most famous Mart, the animal Spirits, preparing for the performance of the thing willed, are directed into appropriate Nerves. That it is so, it appears, because every influence from the Brain into the nervous stock, and on the contrary, from this into that, and the mutual commerce of the animal Spirits, must of necessity pass through these bodies. Wherefore all the Nerves, also those which belong to the more inward Organs of the Senses, arise behind these chamfered bodies. For the Optick and smelling Nerves creep through the superficies of the Brain by a long passage and windings about, that they might be inserted below this part of the oblong Marrow.

For indeed, the Species of sensible things, received by those Nerves, might more immediately be carried to the middle of the Brain, unless that they ought first to be staid at this Sensory. Further, we may lawfully conjecture, that these parts perform the aforesaid office from their chamfered, and as it were beamy contexture: For as those chamferings, with which these bodies are marked, (as we but now intimated) are of a double kind, to wit, some descending, which look from the Brain towards the oblong Marrow; and others ascending, which are carried distinctly from this towards that, it may be lawfully concluded, that in these carried upwards, the impressions of sensible things are perceived: and in those tending downwards are performed the Instincts of Motions.

Further, that these bodies, as was said, perform the offices of the first Sensory, besides the fabrick of their parts, and the Analogy to be collected thence of their use, it seems yet more certainly to appear from some Observations concerning these chamfered bodies, after what manner they are affected in Paralytick diseases. For as often as I have opened the bodies of those who dyed of a long Palsie, and most grievous resolution of the Nerves, I always found these bodies less firm than others in the Brain, discoloured like filth or dirt, and many chamferings obliterated. Further, in Whelps newly littered, that want their sight, and hardly perform the other faculties of motion and sense, these streaks or chamferings, being scarce wholly formed, appear only rude.

The chamfered Bodies, inclining one to another near their blunt and greater angles, are almost contiguous; but that the Trunk of the *Fornix* intervenes with its twofold Root: yet in that place where the two Roots of the *Fornix*, being sent straight down, are inserted into the callous Body, a transverse medullar process, like a great Nerve, stretched from one chamfered body to the other, as it were joyns the same, and makes

makes them to communicate one with the other. Certainly, this joyning together of the chamfered bodies is made, that their actions and passions may not be double: but though the species of the sensible object or conceptions of the motions to be performed, coming from the Brain or Sensory being double, are carried also double to the first Sensory; yet for as much as either substance or frame of this, communicates with the other, every impression coming this or that way, becomes still one and the same. For it may be observed, in the whole Head, that though almost all things are double, yet each of them communicate among themselves, either by a contiguity, or by processes sent forth. And so as by the duplication of it, care is taken against the absolute privation or defect of the act, so the joyning together of its duplicature provides against the empty or confuse multiplication of the same species.

After this manner, the chamfered bodies in Man and four-footed Beasts are constantly found of the same species or form, and in every one of them, figured after the same manner; and are as it were the Joynts that joyn the Brain to the shanks of the oblong Marrow. But we have already shewn, that in Fowls and Fishes, whose brains being alike, differ from those of men and four-footed beasts, the thing is somewhat otherwise: For in Fowls the callous body is wanting to the brain; but what serves instead of it, is found in the oblong Marrow, to wit, two little Ventricles shew themselves nigh the chambers of the Optick Nerves, which are arched or chamber'd with a whitish substance; such as the callous body is in man or four-footed beasts. Then on the contrary, the chamfered bodies, or the parts which serve in their stead, in Fowls, are not a portion of the oblong Marrow after the usual manner, but are entred into the Brain it self. For near the fissure of the Brain, two Membranes being marked with medullar chamferings, both distinguish either Hemisphere of the Brain, and cover over its Ventricles. The streaks or rays of either Membrane descend, and being concentred about the Basis of the Brain, go together into a medullary process, which is inserted on both sides to the oblong Marrow. So these parts, viz. the callous body, in which the animal Spirits are expanded, and the chamfered bodies, in which their passing to and fro is instituted, seem to be transposed in the head of Fowls. The reason whereof, (as I elsewhere hinted) unless I be deceived, is this: because these Animals are of less excellency in Imagination and Memory than four-footed beasts; yea also, for that the sense and motion of them are their chief Faculties: therefore for the exercises of these to be performed with a greater expansion of Spirits, the callous body is transferred into the oblong Marrow, and in its place the chamfered bodies are removed into the Brain.

About the lower end of either chamfered body the smelling Nerves are inserted. For you may take notice, that the mammillary Processes, a little more obscure in man, but much more conspicuous in brute Animals, who are endued with a more remarkable sense of smelling, do pass into firm and plainly whitish bodies of Nerves, which being dilated or brought nigh the lateral turnings and windings of the Brain, are implanted into the oblong Marrow on either side about the lower angle of either Ventricle behind the chamfered bodies; yet so, that the Tube or Pipe of either Nerve may open into the Cavity of the Ventricle, as we before shewed. After this manner these Nerves are carried by a long journey from the fore-part of the Brain, that they may bring the sensible species to the chamfered body, as to the common Sensory, first and rather than to the Brain. But we shall speak of the smelling Nerves more particularly hereafter.

Where these chamfered Bodies end from either side, a marrowy substance succeeds, which being somewhat of a darkish colour going forward for some space, is distinguished by a peculiar bending forward from the other contiguous parts. This *Galen* (perhaps not improperly) calls the Chambers of the Optick Nerves; for in this place the Optick Nerves shewing themselves from the highest region of either side, being carried downward with a certain compass, are united about the Tunnel. Then being divided again, and carried a little further, enter the Skull, going straight forwards to either Sensory. The growing together of these Nerves, and their being again separated, seems to be ordained for this end, that the visible species, received from either Eye, might appear still the same, and not double; for this conjunction of the twofold Organ frames the double image into one; which once united, when afterwards it is carried to either side of the common Sensory, for that it is on both sides alike, appears still the same. If at any time, through drunkenness, or a distortion of the Eyes, the object appears double, and two Lights upon a Table, it is because

the image of the same thing is received after a different manner by one Eye than the other, for that reason the objects are represented like two distinct things. For that this Eye is distorted after one manner, and that after another, the same Species, coming to either Pupil by a diverse angle of incidence, appears diverse or double. There is another reason of the coalition of the Optick Nerves, to wit, that one Eye being hurt, all the visible animal Spirits might be bestowed on the other. Further, for that these Nerves are carried with a long passage, their uniting helps to their mutual strength and support.

Whereas the Optick Nerves arise here from the oblong Marrow, all or its most intimate substance is not bestowed upon them; but these Nerves are inserted into the medullar Trunk, as branches of a Tree to the stock, that so they may receive by that means the influence of the Spirits, and by this way transmit the Species of visible Things. In the mean time, this more inward substance of the oblong Marrow is the common passage both to the Eyes and to the other nervous System arising more backward: through which, by the going and returning to and fro of the animal Spirits, the impulses of sensible things, and the instincts of Motions between the Brain and the other nervous parts, which depend upon it, are performed. Forasmuch as the smelling and seeing Nerves arise so near the chamfered bodies, the reason hence is plain, why odors or the objects of the sense of smelling so strike the Brain it self, and immediately affect it; also why there is so exceeding swift a communication between Sight and Imagination.

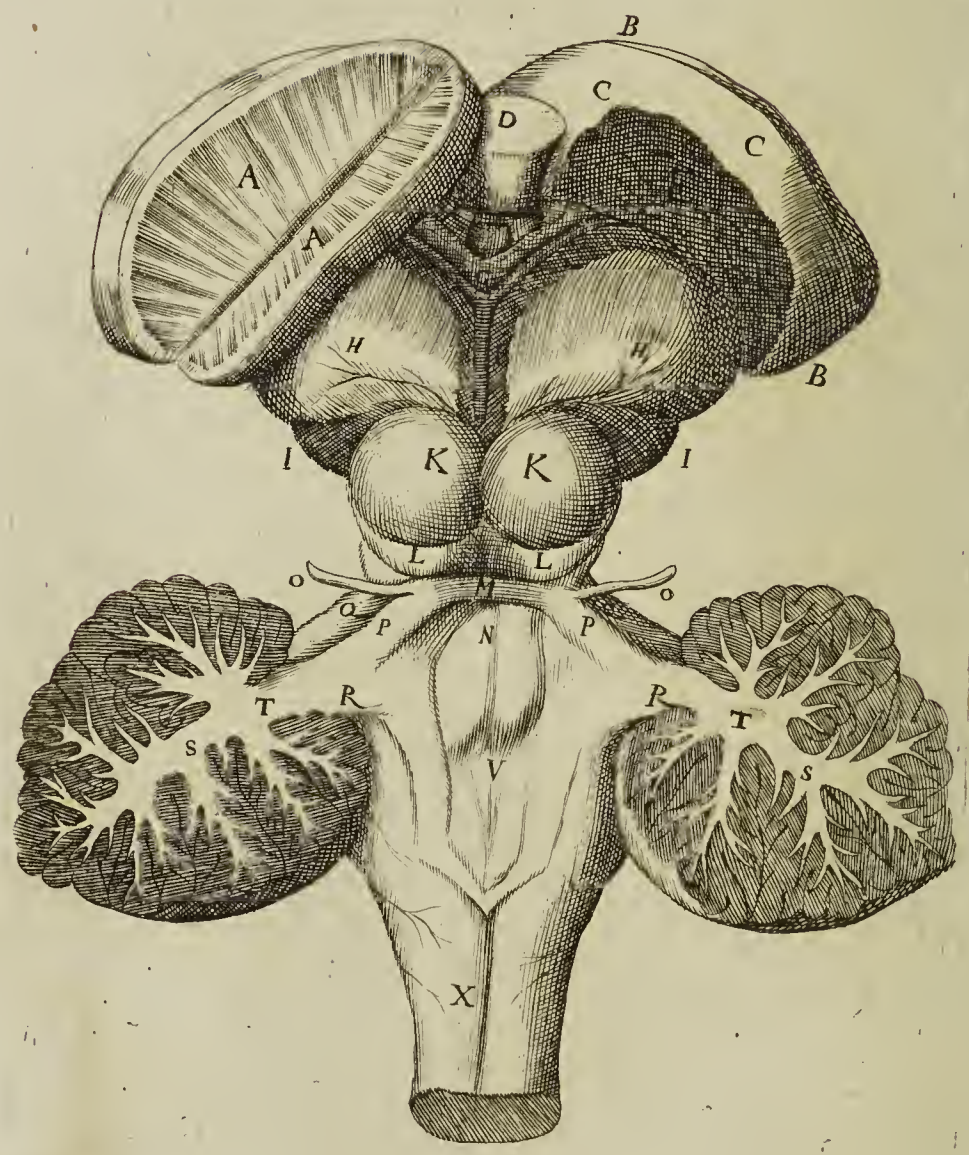
Concerning the Optick Nerves in a man, (which also in some measure is after the same manner in other living Creatures) we shall advertise you, that when they, after their uniting or mixing together, being presently again separated, do go out of the Skull, the sanguiferous Vessels going out of the Skull with them, and following either Nerve even to the Basis of the Eye, are knit into the Trunk of either. There is a noted shoot of the Artery destined to this office, carried from the anterior branches of the *Carotides*. Hence, as I suppose, a reason may be given, wherefore, when by drinking or more plentiful eating, a sleepiness is caused, presently a great heaviness, and as it were an oppression, is felt about the Eyes. For when the blood, very much boiling up, fills above measure the Vessels watering the Brain, and by distending them, obstructs the Pores of the Brain, those Nerves also from the blood in like manner boiling up within the Optick Vessels, are pressed together in their whole passage.

In Fowls and Fishes this chamber of the Optick Nerves, bunching out with a great bulk, is not much less than the Brain it self; for, as we but now intimated, what is instead of the callous body is placed here; and in this place the animal Spirits seem to have their chief Mart or Empory in a most large medullar chamber, or the Sphere of their Expansion. And so, when from hence the animal Spirits are derived from so full and plentiful a Store-house, it is for that reason Fowls are furnished with so curious an Eye, and with so highly perspicacious and acute a sight. And the same perhaps may hold concerning Fishes; if that we consider the sight in these is performed in a thicker Medium, and often double.

In some Animals, in the midst of these chambers of either Optick Nerve, the shanks of the oblong Marrow a little opening, leave a chink or aperture, which receiving the ferocities coming from every region of the Brain and its Appendix, sends them through the Tunnel into the pituitary Glandula.

There is no need that we should discourse much here of the Tunnel and the pituitary Glandula, because, already speaking of the Ventricles of the Brain, or the empty space left within its plicature, we fell occasionally on the consideration of both these; where we shewed, that the ferous humors, which were wont to be heaped together within many places of the Brain and of its Appendix, do all slide down on every side from each angle and recess of it into the steep opening of the Tunnel; and so there is a necessity that they should be poured out by it into the pituitary Glandula. Further, it is manifest, that this Glandula, in some Animals, is charged with a double office; to wit, as it receives the ferocities sent from above from the Brain, so also it separates the humors from the blood brought to the same from the wonderful Net by the Arteries, and prepossessing them, imbibes them before their ingress to the Brain. Wherefore this part is furnished with a substance of a double kind: viz. one reddish, more thin, and interwoven with Blood-carrying Vessels, which constitutes either side of it; and the other more white placed in the middle, to which the Tunnel is inserted.

But



But having shewn, that this Glandula receives the humors so brought by a double Tribute, we did diligently inquire concerning the ways and means whereby they are at length carried away from thence: and as it appears by an Experiment, that there is a passage open from this Glandula into the Vessels lying underneath the bone, and from thence into the Jugular Veins, we affirmed, that 'twas most likely, that the humors to be carried away from this Glandula, (after the manner of others) may be reduced at last into the bloody mass. I shall not add any more concerning these things, but proceed to the other parts of the oblong Marrow. But that, what hath been said, concerning the shanks of the oblong Marrow, and their tops, viz. the chamfered bodies, may be the better understood, it will seem to the purpose that we represent the Images of all these in the following Figure.

The Eighth Figure

R Represents the oblong Marrow taken out of the Head of a Sheep with the Brain cut off and removed, and with the Cerebel and one streaked Body cut in two in the middle, and other things chiefly belonging to the medullar Trunk.

- AA. The chamfered Body cut in two in the midst, that its marrowy chamferings may appear.
- B. The other chamfered Body whole covered with the Choroeidal Infolding with the extreme portion of the callous Body CC. sticking to the same.
- CC. The brim or extremity of the callous Body cleaving to the chamfered Body.
- D. The Basis of the Fornix.
- E. The right wing of the Choroeidal Infolding.
- F. The passage of the Veins being stretched out from the fourth Bosom, which being presently forked, constitutes the veinous portion of either wing of the Choroeidal Infolding; under the beginning of this passage, very much beset with Fibres and sanguiferous Vessels, the Pineal Glandula lyes hid.
- G. The hole or chink leading to the Tunnel.
- HH. The chambers of the Optick Nerves.
- II. The medullary Processes, or the ways of passage which lead from the medullar stock into the orbicular Protuberances.
- KK. The Buttock-form orbicular Protuberances.
- LL. The lesser Protuberances called Testes.
- M. The meeting together of the Processes ascending obliquely from the Testes into the Cerebel.
- N. The hole of the lower Ventricle lying under the orbicular Protuberances.
- OO. The Pathetick Nerves of the Eyes.
- PP. The medullary Processes stretched out from the Testes into the Cerebel.
- QQ. Other medullar Processes, which being sent from the Cerebel towards the oblong Marrow, compass about its stock, and constitute the annular or ringy Protuberance.
- RR. The lowest or third Processes of the Cerebel, which being inserted to the medullar Trunk, become additional cords or strings of it.
- SS. The medullar Ramifications or Branchings of the Cerebel.
- TT. The middle marrows of either Cerebel in which its three medullary Processes, constituting either little foot of it, grow together.
- V. The Ditch constituting the fourth Ventricle in the medullar Trunk.
- X. The extremity of the oblong Marrow about to end in the Spinal.

C H A P. XIV.

Of the Uses of the Pineal Glandula and the Choroeidal Infolding ; also of the orbicular Prominences which are commonly called Nates and Testes ; and other Parts which seem to be dependences of them.

Below the Chambers of the Optick Nerves in a common Valley which lyes between the tops of these and the Buttock-form Prominences, is placed the Pineal Glandula or Kernel in form of a Pine-apple, called also *Conarium* ; this is not only found in Man and four-footed beasts, but Fowls and Fishes also are endued with the same. Wherefore, although from hence it may be concluded, that this is of necessary use ; yet we can scarce believe this to be the seat of the Soul, or its chief Faculties to arise from it ; because Animals, which seem to be almost quite destitute of Imagination, Memory, and other superior Powers of the Soul, have this Glandula or Kernel large and fair enough.

It is observed in all Animals of every kind and form, that to this Glandula, always placed nigh the holes or passages, open to the Tunnel, the Choroeidal Infolding is continually joyned ; yea this infolding (seeming to hang from the Pineal Kernel sustaining its middle Process, as it were by a nail or hasp, from thence) is divided into two wings stretching out on either side upon the shanks of the oblong Marrow, Wherefore we may justly suspect, that this Glandula is chiefly made for the sake of this infolding ; and that the office of it is no other than of other Kernels, which are placed nigh the concourse of the sanguiferous Vessels : to wit, that it may receive and retain within it the serous humors deposited from the arterious blood, till the Veins being emptied, may sup them back, or the Lymphæducts (if there be any there) may convey them outwardly. For it is observed, that the Choroeidal infolding is beset with very many lesser Glandula's or Kernels, and every where interwoven with them, which imbibe the Serum secreted from the blood, in the smaller Vessels ; therefore for this very same office, where all the Vessels concur, this Kernel is placed, of a bigger bulk, that it might be able to receive and contain the serosities there plentifully deposited. Moreover, it is of no small moment, that this Glandula sustains and keeps duly stretched out the *Chorooidal* infolding otherwise hanging loose, and apt to fall down into it self, or at least to slide out of its proper place. Wherefore I have often taken notice in the Dropsie of the Brain, that this *Glandula* being loosened at the roots by too much moisture, and often broken off, and removed from its place, the *Chorooidal* infolding hath slid together from its proper expansion, and slip'd down lower, and also suffered its Vessels to be folded together disorderly.

From these things thus premised concerning the pineal Glandula, it will not be difficult to assign also the use of the *Chorooidal* infolding : Concerning which there will be little need to refel that Opinion of the common sort, which asserts, That the animal Spirits, to be bestowed upon the whole Brain, are begot in this infolding : because the Vessels of this instil nothing to the substance of the Brain or its Appendix, for that they are no where inserted to it ; but it was before shewn, that the Ventricles of the Brain, or the Cavity in which these same Vessels are hung, do not at all contain the Spirits ; which further appears more plain, because in Cephalick diseases those Ventricles are filled with water, and the continuity of the infolding is dissolved by too much moisture, when in the mean time the sick are indifferently strong in the exercise of the animal Faculties.

But indeed we suppose, that this infolding serves for a twofold office : *viz.* First, that the more watry part of the blood, destinated for the Brain, might be sent away into its Vessels, to the end, that the remaining portion of the bloody *Latex* might become more pure and free from dregs to be distilled forth into Spirits ; even as is wont to be done in a Chymical Distillation, to wit, when there is a peculiar Receiver fitted for the receiving of the Phlegm by it self, more sincere, pure, and subtil Spirits are instilled into the other more noted Receiver. The more watry blood entring the arterious Vessels of this Infolding, being carried from them into the Veins, is remanded back towards the Heart. In the mean time, lest the Serum, too much redounding,

ing, and boiling up in these Vessels, might hinder circulation, its superfluities are received for some time both by the lesser Glandula's thickly inserted, and also by the pineal Kernel.

The other and no less noted use of this Infolding, is to conserve the heat of the blood boiling within the complications of the Vessels, and as it were circulating about, being excited as from a fire-place within the infolding of the Brain. For though the *Pia Mater* need not implant thick shoots of Vessels in the callous Body and inward Marrows of the Brain, for that they are rather dedicated to the Exercise than to the Generation of the animal Spirits; yet that the heat requisite for the circulation of the Spirits, might be kept constantly in that place, this infolding is hung upon the whole neighbourhood. For as the blood, aggested or heaped together within the Cavities of the Bosoms, is instead of an hot Bath, whereby the animal Spirits are distilled plentifully into the outmost and cortical part of the brain; so the blood contained within the small Vessels of this infolding, seems to be in the place of a lesser and more temperate Bath, whereby the same Spirits might be fitly circulated in the more inward and medullar substance.

Lastly, Another reason may also be given, why the Choroeidal infolding is found always within the Ventricles or Cavity of the Brain, made by its infolding, and after what manner soever figured; to wit, that another sort of commodity might result from thence; that when the Vessels of that Infolding, carrying too watry blood, lay aside more Serum than the Glandula's are able to receive or contain, what is superfluous might slide down opportunely into the underlying Cavity, as into a Sink. Wherefore the *Pineal Glandula*, though set in a more eminent place, is however placed always near the hole or passage that lyes open towards the Tunnel in every brain.

Next to the Pineal Kernel are found in the upper superficies of the oblong Marrow certain noted Prominences, which are commonly called *Nates* and *Testes*. These being placed near together, do constitute as it were four Mole-hills, which yet are joyned one to another by certain processes. Beneath these Mole-hills, or rather between the joyning of them and the trunk of the oblong Marrow, placed underneath, a narrow and long Cavity or Den is left, which by some Anatomists is called the fourth Ventricle; but according to others later, who place the fourth Ventricle under the Cerebel, this Cavity is affirmed to be a passage to it.

The hinder extremity of this Den ends nigh the beginning of the fourth Ventricle; the more fore-extremity of it opens before the former Mole-hills or little bulkings out, called *Nates*. From the midst of this Cavity or narrow Den a passage goes straight to the Tunnel. It is very much controverted among Anatomists concerning the use of these parts, and of their dependency on one another, and of other parts, and of their use: Concerning which this is first to be noted, as we hinted above, that these four Protuberances are far greater in some brute Animals than in a Man, as in a Sheep, Calf, Goat, and the like; also in a sound, dry, and old Head they are more conspicuous, and their processes, joynings, and habitudes may be more easily noted than in a younger, moist, or otherwise sickly brain. Indeed the use of these (unless my conjecture deceives me) seems far more noble, than that they should deserve those vile names of *Nates* and *Testes*, Buttocks and Testicles.

Notwithstanding, to what office these parts were designed, neither have the ancient Anatomists delivered, nor will it, by the help of Reason, be easie to guess for certain. We have already shewn, that these aforesaid Prominences ought not to be taken for the two shanks either of the Brain or Cerebel bending back one towards another, and so growing together into the oblong Marrow. For although from this supposition a very neat Hypothesis may be made for the œconomy of the animal Function, to wit, by affirming that these double shanks, on either side, were so many distinct ways of passage through which the animal *Spirits*, for the performing of motions, flowed from the Brain and Cerebel into the oblong Marrow, and returned thence from this into those for the performing the acts of the Senses: yet from our Method of Dissecting it plainly appears, that the brain is not fixed to the oblong Marrow nigh this place, but far above it; so that indeed the anterior Prominences, unless mediately only, *viz.* by the chamfered bodies, receive not any portion of the medullar stock, or any influence from the brain, nor can have any dependency from it. Besides, if the Protuberances called *Nates* were shanks of the brain, why should the same be in man, (he having got the greatest brain, the least) or at least lesser than
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in most other living Creatures? Then between the Prominences called *Testes* and the Cerebel, although there happens a certain communication; yet it seems that there lyes open a passage from those little lumps into the Cerebel, and not from this, through them into the oblong Marrow. For out of these aforesaid Prominences a medullar Process ascends obliquely on either side into the Cerebel, by whose passage the animal Spirits, tending from one stage to the other, cause a mutual commerce between those parts and the Cerebel: But indeed the Processes which lead from the Cerebel into the oblong Marrow, and carry to it its influences, being distinct from the former, stand somewhat lower, as shall be more clearly shewn hereafter, when we shall speak of the Cerebel.

But in the mean time, concerning the offices and uses to which the aforesaid Protuberances serve, we shall make this conjecture. The animal Spirits perpetually flow out and leap back again from the fountain the brain into the oblong marrow, so that there may be had a constant commerce between the brain and many organs of sense and spontaneous motion: from which those parts are entertained which perform their actions, not at the beck of the Appetite, but either by the instinct of Nature, or the blind impulse of the Passions; for such receive wholly their influences from the Cerebel, as afterwards shall be more fully shewed. Whilst therefore the Spirits, flowing from the brain, abound in the oblong marrow, it is fit that some of them should be carried from thence into the Cerebel: (for what uses this ought to be done, shall be told by and by) wherefore from either side of the oblong marrow a Protuberance grows forth, into which indeed the Spirits designed for the Cerebel, may go apart from the common passage of the oblong marrow; and these Prominences are the former, which are commonly called *Nates*, and, as we have said, are far greater in most brute Animals than in man (the reason of which shall be declared anon.) The other hinder Protuberances, commonly called *Testes*, grow to these former, and are only certain Epiphyses or Excrescences of them, as it were the heads of the medullary Processes, which are from thence carried by an oblique ascent into the Cerebel; for when the animal Spirits ascend from the former Prominences into the Cerebel, they enter these latter first, as it were the more large beginnings or entrances of their passage, from whence they go forward by the passage of the medullar Processes into the Cerebel.

Besides we may take notice, that when the animal Spirits are carried out of the oblong marrow into the greater natiform Prominences to be derived towards the Cerebel, they, according to their custom, (as often as they tend towards the common Sensory from a double Organ of any Faculty) ought to be confounded and mingled together before they enter the Cerebel: wherefore both the first Prominences, and also the second growing to them are joyned together with certain Processes like wings reaching one another; which connexion indeed of them, because it ought to be distinguished every where from the medullar Trunk lying under it hence, from the separation or empty space that comes between the oblong marrow and the growing together of the Prominences, that cavity arises, which is by some called the fourth Ventricle, and by others the passage to it.

If it be yet farther inquired, to what end the animal Spirits are carried by this by-passage from the common passage of the oblong marrow into the Cerebel, and thence back again; I say, that this is done for a twofold respect, *viz.* both that the Passions or Affections of the sensitive Soul, begun from the brain, may be transmitted to the *Præcordia* and *Viscera*; then secondly, that the natural Instincts, excited in the *Præcordia* and *Viscera*, might be communicated to the brain. These reciprocal commerces which are had between the brain and the Organs of involuntary Functions, ought to be instituted or performed by this private passage, lest otherwise the exercises of these involuntary Faculties should very much disturb the acts of the outward Senses, or the intentions of spontaneous motions.

As to the first, it is observed, that by every passion of the sensitive Soul, as from Anger, Sadness, Pleasure, and other Affections, the *Præcordia* are disturbed, whether we will or no; which variously dilate or constrain themselves, and so stir up in the blood divers fluctuations. Moreover, from this kind of force of the Passions the countenance or the aspects of the Face are wont to be altered and distorted after various ways. The reason of all these seems to be, because when the animal Spirits, existing within the brain, are moved according to the Idea of the conceived Passion, the other Spirits also flowing within these diverting places, being in like manner moved,

moved, affect the Cerebel, and that coming between, the original of the Nerves, serving to the *Præcordia*, *Viscera*, and Muscles of the Face, and so the parts to which those Nerves are distributed, are also stirred up or provoked into motions answerable to the same passion.

But the aforesaid Prominences and their dependences serve no less also for the conveying of the impressions of natural Instincts to the Brain, that from thence the Appetite and local motions might presently be retorted: by which all the exigencies or wants perceived by the *Præcordia* or *Viscera* might be supplied. When in a young one newly born the stomach cries out for hunger, the Instinct of this is carried by the passage of the Nerves to the Cerebel, and from thence by the medullar Processes to these Protuberances; and the Spirits there inhabiting, form the Idea of the impression, and carry it to the brain, wherein presently, without any previous knowledge or experience, such kind of conceptions of the Soul are stirred up, that every little living Creature presently seeks out the Mothers breasts and sucks.

But it may be objected, it does not seem of necessity we should suppose these kind of acts of the Passions and Instincts to be made apart in this by-place; for why are not the commerces of the animal Spirits ordained by the influence from the Brain into the Nerves leading to the *Præcordia* and so back again through the common passage of the oblong Marrow? But to that it may be readily answered, That this reciprocal motion of the Spirits ought to be made through the middle region of the Cerebel, from one stage to another for the exercise of these Faculties: And therefore (since that all manner of communication between the Brain and Cerebel is performed by these Prominences) there should also be had a passage by the same way between this and the Organs of the Functions merely natural. Besides, if the rage or furious motions of the Passions and Instincts should be carried in the same path in which the forces of sensible things are carried, their acts might be greatly confounded by the mutual meeting or gathering together of the animal Spirits. But this kind of Hypothesis concerning the Acts and Progress of the Passions and natural Instincts, shall be made more clear afterwards, when we design the Actions and Uses of the Cerebel, and of the other parts, which in like manner seem to be destinated to the same offices with these Protuberances.

In the mean time, what we have affirmed, that the latter Prominences are only Additional or Excrescences of the former, will clearly appear to any one beholding them. But this, as we have already hinted, is seen without Controversie in the brains of a Calf, a Sheep, and some other four footed beasts; where, when the *Nates* are signally great, the *Testes* grow to the same in a very small bulk. Further, that the medullary Processes lead from these into the Cerebel, and convey the animal Spirits by this by-path, is so manifest, that none who hath carefully beheld these parts, can be able any further to hesitate or be doubtful of it. For indeed the little hairs or fibres wherewith these processes, ascending into the Cerebel, are marked, are otherwise figured and placed than those which are beheld in the neighbouring processes descending from the Cerebel towards the oblong Marrow.

Moreover, either pair of Prominences do not only communicate among themselves mutually by their stretched out wings, but also another medullar Process, going cross-wise, knits together the aforesaid Processes stretched out from thence into the Cerebel; and from this joyning together of them two small Nerves are produced, which bending down on either side, and being carried forward, enter the *Dura Mater*, and so go straight through it, till having reached to the moving Nerves of the Eyes, they go forth of the Skull at the same hole with them, going forward straight to the Trochlear Muscle of the Eye. Concerning these little Nerves it is observed, that when many others proceed from the sides or the Basis of the oblong Marrow, these arise from the aforesaid Prominences in the bunching forth at the top. The reason of which, if I be not mistaken, is this: We have affirmed, that these Prominences do receive and communicate to the Brain the natural Instinct delivered from the Heart and Bowels to the Cerebel; and on the other side, or back again, do transfer towards the *Præcordia*, by the mediation of the Cerebel, the forces of the Passions or Affections received from the Brain; but in either action the motion of the Eyes is affected with a certain manifest Sympathy. For if pain, want, or any other signal trouble afflicts the *Viscera* or the *Præcordia*, a dejected and cast down aspect of the Eyes will declare the sense of its trouble: when on the contrary, in Joy, or any pleasant Affection of the *Præcordia* or *Viscera*, the Eyes are made lively and
sparkle

sparkle again. In like manner, the Eyes do so clearly shew the Affections of the Mind, as Sadness, Anger, Hatred, Love, and other perturbations, that those who are affected, though they should dissemble, cannot hide the feeling and intimate conceptions of the mind. Without doubt these so happen, because the animal Spirits, tending this way and that way in this diverting place between the Brain and the *Precordia*, do at once strike those Nerves as the strings of a Harp. Wherefore from this kind of conjecture which we have made concerning the use of these Nerves, we have called them Pathetical, although indeed other Nerves also may deserve this name.

There yet remains for us to take notice of the aforesaid Prominences, that either of these pairs, and the Processes hanging on them, are distinguished from the trunk of the oblong Marrow lying under by the Cavity between them; so that this Cavity or Ventricle seems to exist only secondarily, because the empty space between the aforesaid bodies, placed above and beneath, separating the same one from another, ought to come between. But this Cavity seeming to result so by accident, hath a very signal use; for in the middle of its passage a sloping aperture reaches towards the Tunnel, through which the humors sliding into either of its holes, one made more forward, the other more backward, are sent out. The more forward hole is placed between the chambers of the Optick Nerves, a little before the pineal Glandula, into which the serous heap being laid up nigh to the confines of the oblong Marrow, slides by degrees: but the other hole is opened more backward into the fourth Ventricle which is planted under the Cerebel; which hole is covered with a thin Membrane, which girding about its mouth and that of the Cerebel, provides lest the humors, derived from the fourth Ventricle, or the confines of the Cerebel, should fall down any other way than into that hole; but if at any time that little hole be broken asunder by a deluge of the Serum, the watry Latex sliding down upon the Basis of the oblong Marrow, overwhelms the origins of the Nerves, and so brings Convulsive distempers and meltings, and not seldom deadly, of the vital Spirits, as I have observed in the bodies of many dying of Cephalick Diseases.

CHAP. XV.

Of the Uses of the Cerebel, and of some of its Parts and Processes.

HAVING hitherto continued the former Tract of the oblong Marrow, which as it were the Kings Highway, leads from the Brain, as the Metropolis, into many Provinces of the nervous stock, by private recesses and cross-ways; it follows now that we view the other City of the animal Kingdom. The situation of this being remote enough from the former, its kind of structure is also different from it: yea it seems that there are granted to this, as to a free and municipal City, certain Priviledges and a peculiar Jurisdiction.

The Cerebel is placed a little below the orbicular Prominences in the hinder part of the Head; where growing to the trunk of the oblong Marrow by a double little foot, it appears almost of a Spherical figure. Its superior gibbosity coheres towards the superficies to the border of the Brain by the intervention of the *Pia Mater*; but nevertheless it is intimately united to it, nor is there any immediate commerce between this or that or their parts. There hath been spoken enough already of the figure and situation of the Cerebel, and of its various Processes, and how it is fastned to the oblong Marrow; it now remains that we proceed to design or draw out the offices and uses of it, and its several parts. Where in the first place shall be inquired into, what kind of office the Cerebel is endued with in the animal œconomy; then when we shall descend to particulars, there are more things worthy to be noted, which will offer themselves to our consideration: *viz.* first the infoldings of the Vessels covering the whole compass of the Cerebel, and especially its hinder part, with the heap of Kernels: secondly, its folds and lappets ordained with a certain and determinate series, and almost after a like manner in all: thirdly, the double substance of the folds, *viz.* cortical and marrowy: and the concentring of all the medullary tracts in two large Marrows or middests: fourthly, either little foot or pedestal of the Cerebel made out of those two middle Marrows: and in either pedestal three distinct

distinct medullar Processes to be found: fifthly, the annular Protuberance made by a process of the Cerebel descending into the medullar Trunk: sixthly, some Nerves, which arising immediately from this Protuberance and other Nerves in the neighbourhood, which being designed for the involuntary Function, receive the influences of the animal Spirits from the Cerebel: Lastly, the Ventricle or Cavity lying under the Cerebel ought to be considered.

1. As to the office or use of the Cerebel in general: nothing of it occurs, spoken by the Ancients, worthy its fabrick, or agreeable to its structure. Some affirm this to be another Brain, and to perform the same actions with it: but if any one should have a soft and foolish Brain, I greatly doubt, if he should become wise, though he should obtain perhaps a more hard and solid Cerebel. Others place the Memory in this part, supposing the Cerebel to be as it were a Chest or Box, wherein the Ideas or images of things, before laid up, are kept apart from the incourle of fresh Species. But it is far more probable, that this faculty resides in the cortical spires of the Brain, as we have elsewhere shewn. For as often as we endeavour to remember objects long since past, we rub the Temples and the fore-part of the Head, we erect the Brain, and stir up or awaken the Spirits dwelling in that place, as if endeavouring to find out something lurking there; in the mean time, there is perceived nothing of endeavour or striving motion in the hinder part of the Head. Besides, we have shewn, that the Phantasie and Imagination are performed in the Brain; but the Memory depends so upon the Imagination, that it seems to be only a reflected or inverse act of this: wherefore that it should be placed with it in the same Cloister, to wit, in the Brain, is but necessary; for it plainly appears, that there is no immediate commerce between the Brain and the Cerebel.

When some time past I diligently and seriously meditated on the office of the Cerebel, and revolved in my mind several things concerning it, at length, from the Analogy and frequent Ratiocination, this (as I think) true and genuine use of it occurred; to wit, that the Cerebel is a peculiar Fountain of animal Spirits designed for some works, and wholly distinct from the Brain. Within the Brain, Imagination, Memory, Discourse, and other more superior Acts of the animal Function are performed; besides, the animal Spirits flow also from it into the nervous stock, by which all the spontaneous motions, to wit, of which we are knowing and will, are performed. But the office of the Cerebel seems to be for the animal Spirits to supply some Nerves; by which involuntary actions (such as are the beating of the Heart, easie Respiration, the Concoction of the Aliment, the protrusion of the Chyle, and many others) which are made after a constant manner unknown to us, or whether we will or no, are performed. As often as we go about voluntary motion, we seem as it were to perceive within us the Spirits residing within the fore-part of the Head to be stirred up to action, or an influx. But the Spirits inhabiting the Cerebel perform unperceivedly and silently their works of Nature without our knowledge or care. Wherefore whilst the Brain is garnished as it were with uncertain Meanders and cranking turnings and windings about, the compass of this is furnished with folds and lappets disposed in an orderly series; in the spaces of which, as in designed Orbs and Tracts, the animal Spirits are expanded according to the Rule and Method naturally impressed on them. For indeed those in the Cerebel, as it were in a certain artificial Machine or Clock, seem orderly disposed after that manner within certain little places and boundaries, that they may flow out orderly of their own accord one series after another without any driver, which may govern or moderate their motions. Wherefore forasmuch as some Nerves perform some kind of motions according to the instincts and wants of Nature, without consulting the government of the will or appetite within the Brain, why may it not be imagined, that the influence of the Spirits is derived wholly from the Cerebel for the performing of these? For it seems inconvenient, that for these offices which should be performed without any tumult or perturbation, the Spirits should be called out of the Brain, which are continually driven into fluctuations as it were with the winds of Passions and Cogitations.

As I only imagined of the use of the Cerebel after this manner, I was led to it at length by a certain thread of Ratiocination; to which afterwards happened an Anatomical inspection, which plainly confirmed me in this opinion. For in the frequent Dissection of the Heads of several sorts of Animals certain Observations did occur, which seemed to put this matter out of all doubt. For I first observed, the pairs of Nerves, which did serve to the Functions, wont to be performed by the Instinct of Nature;

ture, or the force of the Passions, rather than by the beck of the will, so immediately to depend on the Cerebel, that from thence only the influence of the animal Spirits seems to be derived into their origines or beginnings. By what means the Nerves arising from the Cerebel, or receiving from it the provision of the animal Spirits, do perform only involuntary actions, shall be declared hereafter; in the mean time, for the confirmation of this Opinion, we have in readiness another Reason of no less moment.

Therefore secondly, we took notice, that not only the conformation or make of the Cerebel was ordained after a certain and peculiar manner, that is, that its frame or bulk was couched together with folds or little circles, disposed in a certain distinct series, and apt method, and proportionate within themselves, as hath been said; whence it may be argued, that the Spirits arising from hence, and flowing outwardly, are imployed or bestowed on some certain works determinate to one thing. But further it is observed, that in all Animals, although they differ in form and kind, yet the figure of the Cerebel is always very like or wholly the same. The Brain and oblong Marrow are figured in many after a divers manner; for as we have shewed before, there is some difference of these parts found in man and four-footed beasts: but between either of these, and Fowls and Fishes, there is a notable difference as to these parts. Notwithstanding in all these the Cerebel, furnished wholly with the same lappets or little circles alike infolded one in another, is marked with the same form and proportion; which certainly is a sign that the animal Spirits in this work-house are begotten and dispensed, as it were by a certain dimension, for certain necessary offices, which are performed in all after the same manner; and which cannot be any other than the motions and actions of the *Viscera* and *Præcordia*. As to the other Faculties, of which sort are Imagination, Memory, Appetite; yea local motions and sense are exercised after one manner in those living Creatures, and after another manner in others; wherefore their brains are formed after a divers manner. But the motions of the Heart and Respiration in all endued with an hot blood, are performed after a like manner, that is, with a perpetual vicissitude of *Systoles* and *Diafoles*. Besides, another office is to be assigned to the Cerebel, and different from what is convenient or agreeable to the Brain; because where the folds and turnings are wanting in the Brain, they are constantly found in the Cerebel. Besides these reasons drawn from Anatomy, the Pathology of the humane Body affords many others, which confirm the aforesaid office of the Cerebel. For it oftentimes happens, that cruel and horrid Symptoms infest the *Præcordia* and the region of the middle or lowest Belly; whilst in the mean time, the morbifick cause lyes in the Cerebel or nigh its confines. I have known sometimes men labouring only in appearance with a Dyscrasie of the hinder part of the Head, who complained of frequent Swooning and repeated meltings of the Spirits or Deliquiums, as if they were just dying: in whom notwithstanding nothing more could be detected of the morbifick cause or its seat, but that the Patient perceived a great heaviness and pain in the hinder part of the Head, and that upon any sudden motion or bending back of the Head, they were ready to dye. In truth, the Symptoms which are wont to be raised up in the distemper called the *Incubus* or Night-mare, viz. loss of speech, and a mighty weight or load that seems to lye upon the breast, proceed altogether from the morbifick matter fixed in the confines of the Cerebel, and obstructing the passages of the Spirits destinated for the *Præcordia*. But indeed this Hypothesis of the office of the Cerebel shall be more illustrated and confirmed from the uses of its several parts, being rightly designed or drawn forth.

As to the parts and accidents of the Cerebel, 1. we take notice, that the infoldings of the Vessels every where cloath the Cerebel no less than the Brain, also that the ridges and furrows of its folds intimately hide or cover it, which certainly is a sign that the animal Spirits are begotten in this other work-house of them from the watering blood, and instilled into its substance: which thing also more clearly appears, because the Arteries and Veins are not only variously complicated in the superficies of the Cerebel, but both of them in like manner as in the Brain, send forth frequent shoots into its more inward substance; wherefore whilst the most subtil and spirituous part of the blood being carried through long windings about, and as it were serpentine chanel of the Vessels, and so sublimed into Spirits is received within; the bloody part is carried away by the shoots of the Veins sent also deeply down. Further, even as the more watry portion of the blood, destinated for the Brain, runs into

into the *Chorooidal* infolding; (whereby it may there lay aside its unprofitable Phlegm into the Glandula's) so for the sake of separating the Phlegm an heap of Glandula's, with the foldings of the Vessels, as it were a Receptacle fitted for this business, is placed in the hinder region of the Cerebel.

2. From the blood, after this manner cleared from Phlegm, and made subtil by a long circulation, a very pure and spirituous liquor is instilled into the cortical substance of the Cerebel, which is presently exalted by the Ferment there placed into animal Spirits. For indeed we have affirmed, that the Spirits are procreated only in the cortical part of the Cerebel, as in that of the Brain: wherefore, because this kind of Cortex is wanting to the oblong and spinal Marrow, we think these parts do serve only for the exercise of the animal Spirits, and not for their production.

3. The Spirits every where produced within the cortical or exterior compass of the Cerebel, in which they are presently prepared for the work of the animal Function, are derived from all the folds into the medullar tract, and thence into two ample middle Marrows; where they keep full as it were the fountain or spring, and there like the bubbling up of waters, are circulated within with a perpetual turning, and from thence they continually stream forth into the parts of the nervous System proper to themselves.

4. As to the ways of Emanation it is observed, that the two middle Marrows of the Cerebel pass as it were into two pedestals or little feet, by which they are fastned to the trunk of the oblong Marrow; and for that in either little foot of it three distinct medullar Processes are found, all these, or at least two of them, are as it were so many paths whereby the animal Spirits stream forth from their fountain and flow back again.

5. The first of these Processes ascends into the Cerebel from the orbicular Prominences: the use of this we have already declared; to wit, that there may be a certain passage between these Prominences and the Cerebel, in which, whilst the animal Spirits, as in a by-path, move this way and that way, to and fro, they may transmit both the force of the Passions from the Brain by the interposition of the Cerebel to the *Præcordia*, and convey also the natural Instincts delivered to the Cerebel from the *Præcordia* and *Viscera* towards the Brain. But the second Process descending straight from the Cerebel, embraces the medullar Trunk, and so going round about it, constitutes the annular or ringy Protuberance, out of which the fifth, sixth, and seventh pair of Nerves take their originals; so indeed, that this Protuberance seems to be the Ware-house or Store-house of the Spirits flowing from the Cerebel, from which they may influence and be derived into the opposite passages of the Nerves. Lastly, the third process of either little foot, descending from the Cerebel into the oblong Marrow, is inserted into its trunk over against where the eighth pair of Nerves have their original; so that it should seem very likely, the provision of the Spirits destined for this Nerve is derived also by this way from the Cerebel; then what Spirits superabound, remaining longer than this Nerve requires, they sliding down into the common belly or chanel of the oblong and spinal Marrow, increase the plenty of those parts. For this same end the smooth and pyramidal bodies are reached out of the annular Protuberance above the oblong Marrow towards the Spine, to wit, that by the passage of those Processes the Spirits of that provision or stock superabounding, might flow out partly into the beginning of the eighth pair, and partly into the common tract of the medullar Trunk.

Thus much we have spoken briefly and summarily of the Uses of the Cerebel, and of its parts and Processes. But that it may be the better understood, and also that this new thought of Theory concerning the involuntary Function of the animal Regiment, may be more clearly illustrated, we shall here give you a more particular Order or Method of the Spirits brought forth in the Cerebel, and as it were take a view of, or muster their Arms or Forces. Further, it will seem to the purpose, that we should design or draw forth more openly the abundance or plenty of the Nerves receiving their gifts from this Fountain of the Spirits concerning the Acts to be performed only of the involuntary Function.

C H A P. XVI.

Of the various Order and diverse manner of Exercise of the Spirits produced in the Cerebel for the Acts of the involuntary Function.

AFTER having shewn, that the office of the Cerebel is to procreate animal Spirits apart from the Spirits begotten in the Brain, and to dispense them into the Nerves, the Executors of the involuntary Actions and Passions; there yet remains to be unfolded by what manner of œconomy or government the Spirits inhabiting the Cerebel and made free, are busied both by an intestine Circulation, within their proper dwelling places, and also are wont to be expanded and flow out with an exterior irradiation for the necessities and wants of other parts: then these things being shewn, we shall design more particularly the Uses and Offices of the Nerves, and of some other Processes doing service to this Government.

As to the first, as the Cerebel is the other primary Root of the sensitive Soul, or the Fountain from whence the animal Spirits, being diffused through the whole substance of it and its Appendix, are continued still under the same Systasis and radiant Contexture, it is to be noted, that this radiation of the Spirits from the Cerebel doth flow after another manner than the other from the Brain: because this being left to it self, is bestowed by a constant efflux or flowing out on the Organs both of the vital Function and the merely natural, and its expences by an equal continual provision of Spirits, are made up again from the bloody mass continually instilled in. But on the contrary, the Spirits flow out from the Brain, neither by such a continual course without intermission and by little and little, nor are sustained by a perpetual provision and sliding in by degrees; but both the loss of them, and their refection, are uncertain, unequal, and variously interrupted. For neither are the spontaneous Acts of the Function it self, to which they serve, performed after any constant or always the same manner; but according to exterior accidents and occasions we put them forth by heaps, and with a certain force sometimes, and again sometimes we suffer them to be wholly intermitted and unimployed. Therefore the Spirits also are in like manner supplied with an uncertain measure; to wit, they are instilled in sleep plentifully and more copiously, but waking more sparingly and with hard labour, or scarce not at all. Yea the involuntary portion it self of the sensitive Soul (which flows from the Cerebel) for that it hath a near commerce and affinity (as was already said) with the other radicated in the Brain, therefore it is wont to be much disturbed in the performing its office equally and peaceably, and being variously affected and agitated by the impulses sent here and there, or from this place and that, it is compelled, sometimes to contract, sometimes to extend its *Systasis* in the whole or in part, and so is rendred obnoxious to several Passions, and ordinarily instigated to the performing irregular and disorderly actions.

But indeed the contexture of the Spirits, or the part of the Soul irradiating the Cerebel and its Appendix, is both affected with a certain sense, and is urged into motions appropriate to it self, though divers. The sense or Sympathy belonging to this, if it be terminated within the confines of the Cerebel, is always private, nor goes any farther forward to the Brain with a more strong undulation or wavering; and because it is performed the living Creature knowing nothing of it, unless by the effect it cannot be known, for that it excites a peculiar motion. But such an affection of the Cerebel is implanted in it, that by every new disposition of the *Præcordia* and *Viscera* communicated to this from beneath, also from every violent passion excited within the *Forum* of the Brain, and so sent from above, a certain impression is carried to the inhabitants of the Cerebel: by which indeed they are disposed into various ordinations for the performing these or those motions respectively.

For examples sake, so long as the tranquil region of the Cerebel, like a serene and fair Heaven, is free from all perturbation, the Spirits its inhabitants, being poured out with a pleasing sense, or as it were a certain complacency, flow within their proper habitations, both with a gentle circulation, and also with an equal flowing out enter the beginnings of the Nerves serving to the Functions both vital and natural: by which indeed easie Respiration, the Pulse, Chylification, and other offices of the
same

same nature, are performed peaceably. But if that any trouble or molestation happen outwardly to any one, from whence an impression of it is communicated to the Cerebel, presently a troublesome sense being stirred up there, it disturbs the animal Spirits in the Fountain it self, and so is wont to excite irregular motions in the Organs of the involuntary Function. For from hence the frequent alteration of the Pulse and of Respiration, also Cramps of the *Viscera*, and convulsive motions arise unknown to us, or also against our wills. But an impression sent from elsewhere to the Cerebel, and inducing the same kind of troublesome sense, either ascends by the passage of the Nerves from the *Præcordia* and *Viscera*, or it is carried from above from the Brain by the passage of the orbicular Prominences; as shall be shewn more largely anon.

In the mean time, from these things already shewed of the passive power or sense of the Cerebel, it may be easily collected, by what means, with what order and series the animal Spirits, arising from the same, are moved. But first you must distinguish between their twofold motion. For one is customary and ordinary, consisting in a perpetual and equal efflux of Spirits; by which indeed, they flowing into the beginnings of the Nerves nigh their risings, especially of the intercostal and wandering pair, the solemn acts of the Pulse, Respiration, Chylification, and others of the involuntary Function are performed. Then secondly, the other motion happens extraordinary and occasional, which the same Spirits perform confusedly, as it were in disturbed orders: as when the Pulse becomes quicker or slower than it ought, or the Respiration unequal or interrupted; and when the other Faculties, which belong to this Class, are perverted from their regular and constant manner. But these kind of extraordinary motions are again twofold, to wit, for that its instigation proceeds from a double bound; for the impulse whereby the Spirits inhabiting the Cerebel, are compelled into an irregular action, (as we have but now intimated) is carried either from beneath, viz. from the *Præcordia* and *Viscera*; or it is wont to be transmitted from above, to wit, from the Brain.

As to the first, if at any time the *Præcordia* grow too hot, and are burnt with a feverish heat, presently by the passage of the Intercostals and the wandering pair of Nerves, the Spirits residing in the Cerebel, being warned of this evil, institute more frequent and stronger acts both of the Pulse and of Respiration. In like manner, if by chance the humors and sharp Juices irritate or greatly trouble or afflict the Coats of the Ventricles or Intestines through the sense of this affection communicated to the Cerebel, the instinct of performing the motion is reciprocated, whereby the fibres of the parts, being contracted and wrinkled together, endeavour the shaking off of the hurtful matter. More instances might be here brought of all the other acts of the vital or merely natural Function: of which besides it may be observed, that when a sense of the trouble is immediately conveyed from the *Præcordia* or *Viscera* to the Cerebel, this affection, like the waving of waters, is either stopt or terminated there, from whence a motion, as the business requires, unknown to the Brain, is presently retorted, as when the actions of the *Præcordia* are altered by a feverish distemper without our knowledge; or secondly, that sense of the trouble being transmitted to the Cerebel, for that it is more vehement, it unfolds it self more largely, and like a stronger waving of waters, passing through the Cerebel, goes forward further even to the Brain, and warns its inhabitants of the evil; by which they being incited to oppose the enemy, cause a motion of another kind: So (as hath been said) when the *Præcordia* grow cruelly hot, the Cerebel feeling this, makes the Pulse and Respiration stronger. But further, the Brain being warned of the same trouble, seeks and diligently requires cold drink and other remedies to moderate the heat. Moreover, it is after this manner also in several other actions, which though they are regular, yet being made in the Brain without any previous knowledge, they are said to be done by Instincts merely natural; as when brute Animals, being newly brought forth, presently seek for the Dams teats, and greedily suck; or Birds, without any shewing or example, build nests with wonderful Art, lay eggs, and hatch young ones. In these kind of works the Brain being taught before by none, directs fit means to the ends instituted by Nature: which indeed seems to be done by this means. The sense of every necessity being brought to the Cerebel, incites the Spirits inhabiting it to succour it; which when they are not able to do, the impression going from thence further forward, is carried to the orbicular Prominences: by which the Spirits there inhabiting, being presently struck, form the Appetite or the intention of performing,

which

which being thence communicated to the Brain, it readily causes that local motions, fit for the executing of the work, be retorted: Of these we shall speak anon a little more largely, when we treat of the respect which happens between the orbicular Prominences and the annular Protuberance.

In the mean time, we shall take notice in the second place, that the irregular motions of the Spirits inhabiting the Cerebel, are wont also, by reason of the force of the affections, to be transmitted from thence to the Brain: for as often as a violent passion, as Joy, Sadness, Anger, Fear, or of any other kind, is conceived in the Brain, presently the impression of the same being brought through the by-paths of the Prominences into the Cerebel, disturbs the Spirits destinated to the vital or merely natural Function in their very fountain, and for that reason presently induces notable mutations in the Organs of those Functions.

What hath been spoken hitherto of the Cerebel being employed about the offices of the involuntary Function only, also concerning the sense and the motions both usual and irregular of the Spirits inhabiting it, will be made more clear, if lastly we shall shew the offices of the Nerves and of the other processes, immediately depending upon the Cerebel, to be no other than such as perform only involuntary Acts: which shall be briefly and succinctly done, as far as is pertinent to our purpose, because a more full consideration of them is left to another place.

CHAP. XVII.

Of the Nerves, which receiving the stores or companies of the Spirits from the Cerebel, bestow them on the Acts of the involuntary Function.

WE have already shewed, that out of the annular Protuberance (which is a certain Process of the Cerebel) three pairs of Nerves, to wit, the fifth, sixth, and seventh immediately arise. We have said that Protuberance to be as it were a Repository or Store-house, wherein the Spirits flowing out of the Cerebel, and to be derived into the depending Nerves, as occasion serves, are kept: and in the mean time, whilst they remain there, they who stream out from either middle Marrow of the Cerebel divisively, meeting mutually in this Cirque, are united together. But as the aforesaid three pairs of Nerves receive the forces of the Spirits from the Cerebel by the mediation of that Protuberance; so also the eighth pair having its rise near the insertion of the other (*viz.* the lowest) medullar Process sent down from the Brain, seems to derive by its passage the influence of the Spirits no less from the Cerebel: wherefore when these four conjugations of Nerves owe the Tribute of their Spirits wholly to the Cerebel, if I shall shew that all these Nerves serve chiefly and almost only to the involuntary acts of the Senses and Motions, surely this will be a signal Argument, that according to our Hypothesis, the office of the Cerebel is to beget and to dispense the animal Spirits requisite for the involuntary Functions.

Therefore in the first place we observe of the fifth and sixth conjugation of Nerves, that as this arises out of the Basis of the greater Ring, and that from its sides both in man and in four-footed beasts; the fifth pair being carried more forward, distributes its branches into the Glandula's of the Eyes, into the Nostrils, into the Palate, Teeth, yea and into most parts of the Face and Mouth; but the sixth pair is wholly bestowed on some Muscles of the Eyes. Further, out of the trunk of the fifth pair two shoots, and another out of the Nerve of the sixth pair bending back behind, meet together; and what is wonderful, and not before taken notice of by Anatomists, the intercostal Nerves, destinated to the *Præcordia* and *Viscera*, do make a Trunk; so that the Nerves of the fifth and sixth pair stretch out a double Ramification, to wit, one more above about the parts of the Mouth and Face, and the other lower through the *Viscera* of the middle and lowest Belly. But it will appear clearly to any one considering this thing more carefully, that the chief branches of either partition are employed about the involuntary offices of Motion and Sense, of which sort those are chiefly, that either cause the passions, or perform the natural Instincts.

1. Concerning the intercostal Nerve, which (as was said) being radicated in the Nerves

Nerves of the fifth and sixth pair, depends as to its origine wholly on the Cerebel, it is not here to be doubted but that it looking towards the *Præcordia* and *Viscera* in a man, and towards these latter only in most four-footed beasts, is bestowed on the Functions only vital and merely natural, and so confers little or nothing to spontaneous actions. Further, forasmuch as this Nerve reaching forth into the *Præcordia* and *Viscera* of the whole Abdomen, is continued by its superior ramification also into the Eyes, as also into the parts of the Mouth and Face; certainly from hence a true and genuine reason may be given wherefore in every passion the Eyes, Face, and Mouth do so correspond with the affections of the *Præcordia*, often unknown to us or against our minds, that oftentimes we are compelled to betray the most intimate sense of the Heart by the countenance and aspect. Yea, hence a reason may be brought, why in sneezing, yawning, laughing, and crying the Muscles of the Face conspire so in motion with the *Præcordia*. Besides, when in man different from any other living Creatures besides, as we shall shew afterwards, many shoots are sent from the intercostal Nerve to the Nerve of the Diaphragma; this certainly is the cause why risibility is the proper affection of man.

But the Trunk of the fifth pair being carried more forward, and distributing its branchings through the parts of the whole Face, causes the same not only to be pathetically moved, and figured according to the affections of the *Præcordia*; but also produces some acts, both of motion and sensation, of another kind, which for the most part are involuntary, and so seem to depend wholly upon the Cerebel immediately. For example, this Nerve imparts shoots to either mandible requisite for the business of chewing: but it is very well known, that the taking in of the food at the mouth is the first and oldest business of every Animal, which indeed is taught by natural Instinct before any knowledge of the Brain. But as to the Senses, the branches of this pair conduce something to the smelling, but for the most part for the knowing and chusing of favors. Hence it comes to pass, that as odors refresh the Brain by the smelling Nerves, so also they affect the Cerebel by the branch of this pair, and are wont by that means to recreate the *Viscera* and *Præcordia*. But savors or tastes (for that they are almost the peculiar Province of this) carry whatsoever they have of pleasantness or trouble, first to the Spirits inhabiting the Cerebel, and then by their consent to the *Præcordia* and *Viscera*. Hence it is, that a Pectoral not only allays hunger, but the very first tasting of Wine raises up those that are fainting or swooning away. Moreover, forasmuch as from this Nerve certain branches serve for the taste, and others for the smell, there is contracted so strict an affinity between either of these Sensories, that nothing pleases the taste unless it be approved of by the smell: and the loss of one of these senses oftentimes causes the privation or the diminution of the other.

2. Concerning the Nerve of the sixth conjugation we observe, that as one shoot is bent back for a root of the intercostal Nerve, the remaining Trunk of it being carried forward towards the ball of the Eye, is distributed to two of its Muscles, viz. to the seventh, proper to beasts, and to the drawing Muscle. Hence may be inferred, that this Nerve, besides the influence of it bestowed on the vital and natural Function, serves also for the producing some pathetick motions of the Eye, to wit, such as are wont to obey the affections of the *Præcordia* and *Viscera*; so that the whole provision of the animal Spirit, which it receives from the Cerebel, it bestows only on involuntary acts.

3. The seventh pair, or the hearing Nerves, seem also to depend upon the Cerebel, forasmuch as they take their originals out of the annular Protuberance: but the use of them is a little otherwise in man than in four-footed beasts. For in him the annular Protuberance is one, and that very big, from whose lower margin the auditory Nerves proceed: but in Brutes the Protuberance is twofold, viz. one greater, sent down from the Cerebel, in which the beginnings of the fifth and sixth pair of Nerves consist; then near this there is another lesser, and as it were secondary, from which the auditory Nerves proceed. This lesser and lower Ring doth not so manifestly depend on the Cerebel, as the former; but there is stretched out from either height of it a white medullar line upon the oblong Marrow in the bottom of the fourth Ventricle: so as this seems to receive either the Spirits from the oblong Marrow, or at least to carry into the same the sensible Species: for what use it is so constituted shall be inquired into afterwards; for concerning these Nerves of the seventh pair, forasmuch as some offices of them very much illustrate the government or œconomy

atomy of the Cerebel, we shall discourse here a little more largely.

Therefore in man, who hath got a great and undivided annular Protuberance, the auditory Nerves coming out of its margin or brim, shew its stock received of the Cerebel: by which means we may see the tasks of those Nerves quadrate with the assigned government of this. We have shewn before the Processes (which in a manner may be called distinct Nerves) of the seventh pair to be twofold on either side: one, the softer of these, serves only for the sense, but the other harder seems to perform some motions. This latter Nerve, being carried without the Skull, is divided into three branches, all which serve to pathetick motions, or at least to such as are performed without consulting the Brain.

1. The first of them being bent back towards the auditory passage, is bestowed on the Muscles of the Ear. Without doubt, by the action of this, it is effected, that all Animals at the sudden impulse of a sound or noise, erect their Ears at it were to catch the sound too soon passing by. 2. The other branch of this same Nerve climbing over the Muscles of the Jaw, sends forth shoots towards either corner of the Eye: which are inserted into the Muscles lifting up the Eye-lids; the office of which is certainly to open suddenly the Eyes at the sudden approach of any sound, and as it were to call them forth to watch, that by the stroke of the Air being brought to the Ear, the Eye might presently look about to see what is the matter, and whether there might be any danger near or not: which also all Creatures do unthought of. 3. The third branch of the same auditory Nerve descending towards the root of the Tongue, is distributed to its Muscles, and to those of the Bone *Hyoides*, and so actuates some of the Organs for the framing the Voice. For this reason in some measure it comes to pass, that living Creatures being astonished at an unaccustomed or horrid sound, presently putting forth an uncertain voice, cry out and make a noise. But the conformation of these kind of Nerves in man serves for another more noted use, to wit, that the voice might fitly answer to the hearing, and that this might be set as the Echo of the sound admitted by this: so indeed, as on the other side, there be two Nerves of the same pair, the sound is received by the hearing through one, which is rendred again by the voice through the other. The common and extrinsick Echo consists in this, that a certain undulation or waving of the Air shaken or moved, being stirred up, and tending towards or about, when by reason of some stop or hinderance, it cannot go any further directly, being presently repercussed or struck back or reflected at certain angles, it is terminated contrary to the former bound. In like manner, in the hearing, the impression of the sound, or the Species admitted to the Ears by the hearing faculty of the Processes of the same or neighbouring Nerve, and being carried inwardly towards the Cerebel and common Sensory, and from thence again reflected on the vocal process, it is carried out by the Mouth. But between these there is some difference, to wit, forasmuch as the outward Echo renders back the sound immediately; but the sound of the Hearing is not necessarily carried forth at the mouth presently, but that this leaves an Idea in the Head, according to which afterwards, as occasion serves, the voice is formed, which bears the type and image of that, though some time before admitted.

But here (if I may digress a little) we should inquire in what part of the Head the Ideas of sounds are left: whether only in the Brain, which is the Chest of Memory acquired as it were artificial; or whether not also in the Cerebel, which is the place of natural memory? Truly we suppose, that sounds belong to both these, as it were to distinct Store-houses. Every audible impulse being struck against the Ear, it is presently carried by the passage of the auditory Process to the annular Protuberance; but from thence it is carried, as other sensible Species, to the chamfered bodies or the common Sensory; (which way it passes thither, shall be shewed afterwards) this impression tending from thence farther, and being also delivered to the Brain, stirs up the Imagination, and so leaves in its Cortex an image or private mark of it self for the Memory. Further also, as the auditory Process depends on the Cerebel, and receives from it the provision of the animal Spirits: so it is most likely, that by the recess of the same Spirits the Ideas of the Sounds are conveyed also to the Cerebel; which forming there footsteps or tracts, impress a remembrance of themselves, from whence when afterwards the Species there laid up are drawn forth by the help of the vocal process, voices, like the sounds before admitted, and breaking forth in a certain ordained series, come to be made.

Hence it is usual, that musick or melody is soon learnt by some men, which afterwards

wards they bring forth with exact Symphony, without any meditation or labour of the Brain; to wit, from the distinct accents of the heard harmony, the Spirits moving within the Cerebel are disposed into peculiar Schemes; according to which, when they flow on both sides into the vocal process of the auditory Nerve, they render as it were with a certain spontaneous voice, and like a Machine or Clock with the succession of Species, the measures or Tunes of the Instrument which they had drunk in at the ears. Without doubt hence the reason may be sought, why some men learn Musick without any trouble, and others hardly or not at all. For it is observed, that some Children, before they can speak distinctly, quickly sing, and remember certain Tunes; whilst others, though very ingenious men and of excellent memory, are very Fools at Musick, and become incapable, as an Ass for the Harp; wherefore 'tis commonly said, that some have musical ears, and others are wholly destitute of that faculty. In the mean time, 'tis to be confessed, that in these the Organs of the Voice are not defective; but all the fault, though wrongfully, is cast on the hearing.

But in truth the genuine cause of this defect seems to consist in this, that when in all, the audible Species go to the Cerebel sooner and more immediately than the Brain; yet in some the Cerebel being harder, and not easily yielding to the received impressions, those Species, because they could impress nothing of themselves in their passing to the Cerebel, being carried towards the common Sensory, leave their Types or Ideas chiefly and almost wholly in the Brain: which part being still busied with disturbed motions, is less apt to keep distinctly the composures of Harmony. But in the mean time, in others the Species of audible things, besides that they are carried to the common Sensory and to the Brain, do also affect the Cerebel, especially if they are harmonically figured. (forasmuch as in them there is a softer capacity of the impressions) with a peculiar order and Scheme of the animal Spirits: where, as the Species of the Harmony being disposed in convenient little places and cells are kept, afterwards they flow out from thence, almost unthought of, without any endeavour or labour of remembrance, but in a distinct series, and as it were in composed modes and figures, and so by blowing up the vocal processes, they constitute sweet Tunes and vocal Musick.

If that the divers ways of passage are inquired into, to wit, whereby the audible Species, being carried into the annular Protuberance, do get both to the Brain and Cerebel; I say it is not improbable, but out of that Protuberance both a passage lyes open into the underlying tract of the oblong Marrow, and as it were the high road; as also another passage is opened into the Cerebel through the medullar processes of the same Ring. But lest there should perchance be a confusion of the animal Spirits and the sensible Species, (which indeed can hardly be avoided) if the way made for their passage should lye open into various passages and manifold apertures; therefore concerning this it may well be supposed, that the Ideas of the Sounds pass through the Cerebel, when they are carried to the common Sensory; which region being first past, they are at length brought by a by-path, *viz.* through the orbicular Prominences to the chamfered Bodies: which perhaps is partly the reason, that in the Hearing the perception of the sense succeeds so late, and the impulse of the object, in respect of sight, follows so slowly.

Whilst therefore the audible Species passes through the Cerebel, in some men, it leaves in this region (for that it is of a soft temper, and fit for the receiving impressions) tracts and marks of it self, and so they obtain musical ears. But in others who have a harder frame of the Cerebel, they produce no tracts of the same Sounds, and therefore such are wholly destitute of the faculty of Musick.

As therefore we suppose the audible Species to pass through the Cerebel after this manner, a reason may be given from hence, wherefore Musick does not only affect the Phantasie with a certain delight, but besides cheers a sad and sorrowful Heart; yea, allays all turbulent Passions excited in the Breast from an immoderate heat and fluctuation of the blood. For since the animal Spirits, serving for the motion of the *Præcordia*, are derived from the Cerebel; as the perturbations conceived in the Brain, the influence being transmitted hither by moving these Spirits in the Fountain it self, transfer the force of their Affections on the Breast; so the Melody introduced to the Ears, and diffused through this Province, does as it were inchant with a gentle breath the Spirits there inhabiting, and composes them, called off from their fury, to numbers and measures of dancing, and so appeases all tumults and inordinations therein-excited.

From these may in some measure be known the reason of the difference, why the hearing Nerves are after a different manner in man and in four-footed beasts: for, because in these there is little need that the audible Species should pass through the Cerebel, either for the reciprocations of the sound heard, by the voice, or for the impressing there the Tunes of the Harmony (for neither is Musick required, whatever Poets feign, to the taming the Affections which move the breasts of beasts) therefore in these (I mean in four-footed beasts) the annular Protuberance dispensing the animal Spirits to the auditory Nerves, and receiving from them the sensible Species, requires not so strict an affinity with the Cerebel: yea, whenas it may suffice, that those Nerves arise from the oblong Marrow, yet the annular Protuberance, as it were a common Porch, ought to be prefixed to them; to wit, in which both the Spirits going out from either side, and the sensible Species to be carried to either, ought first to be mixed and united together, lest otherwise every sound should become double.

Among the Nerves which are seen to belong to the Cerebel, and to perform its offices, lastly follow the eighth or wandering pair, which indeed hath its rise out of the common Trunk of the oblong Marrow, near the place where the last process of the Cerebel is terminated, and over against where the pyramidal bodies, being produced from the annular Protuberance, end: so that we think these Nerves also, by that process coming between on either side, and also perhaps in some measure through the passage of the pyramidal bodies, do derive all manner of influence of the animal Spirit from the Cerebel.

The beginning of these consists of very many fibres and filaments or little threads presently distinct one from another; to which belongs, from the very beginning of every Nerve, a noted Trunk arising out of the spinal Marrow. The description of the wandering pair of Nerves, and its protension into the *Præcordia* and some *Viscera*, are added hereafter. For the present it shall suffice, that we take notice, that for as much as this Nerve is bestowed chiefly on the *Præcordia*, the acts whereof are involuntary, and are performed without our care or knowledge in sleep as well as waking; and for that the same Nerve seems to receive the forces of the Spirits wholly from the nearer fountain of the Cerebel; from hence it may certainly be well concluded, that the government or œconomy of the Cerebel regards only the involuntary Function.

So much for the Nerves, which being subjected to the Government and Laws of the Cerebel, seem to obey and serve under it: among which moreover ought to be placed the fourth pair, or the pathetick Nerves of the Eyes, to wit, which arising out of the first processes of the Cerebel, come between that and the orbicular Processes; of the use of which we have spoken already. Further, we shall here take notice, that some other Nerves to be described below, for that they communicate with the aforesaid Nerves near their originals, cause also some involuntary acts to be performed; of which sort are first the ninth pair, the spinal Nerve accessory to the wandering pair, also the Nerve of the Diaphragma, and some others, as we shall shew more at large in the particular History of the Nerves.

We may also observe, concerning the Nerves but now described, which owe their stock to the Cerebel, and seem to be designed for the offices of the involuntary Function, that sometimes some of them, though of another Dominion, are compelled to obey the beck and government of the Brain: for we are wont to draw the parts of the Face, usually moved pathetically and unthought of, and also at our pleasure, into these or those Configurations or postures: we are able also in a measure to alter the motions and actions of the *Præcordia* and *Viscera* at the will or command of the Appetite. The reason of these is, partly because the Nerves of either Government communicate variously among themselves with shoots sent forth one to another, so that oftentimes the offices of the one are drawn into the parts of the other. But besides, we have mentioned before, that the sensible impression being inflicted on the parts of the involuntary Function, forasmuch as it is vehement, like a strong waving of water, passing through the Cerebel, affects the Brain it self. In like manner it may be thought concerning the motion which belongs to those parts, viz. that made after the ordinary manner, that it is performed by the command of the Cerebel. Notwithstanding some more severe Edicts of the Brain, by the by-passage of the Prominences, belong also to the Cerebel, and determine the Offices of the Inhabitants of it to be performed at the beck of the Appetite. As every one sees that violent Passions (whether

(whether the will be privy or not) easily do this; why therefore may not the will it self also, as occasion requires, exercise the same dominion? But in the mean time, this derogates nothing from the privileges of the Cerebel, that it may not be called a free and municipal City, and so Mistress of the involuntary Function; for that in some few it is after the manner of the Brain: because the Brain it self in many things is compelled to serve the Cerebel and its Government, as we have already shewn, and is necessarily bound to it. For the Brain owes much to the Cerebel, forasmuch as it receives from the vital Function (which is of its Province) the provision of the blood, and by consequence the Tribute of the Spirits produced of it: so indeed that both these parts, though Principals, perform mutual offices, and as it were in a circle, require and accomplish services one for another.

C H A P. XVIII.

Of the relation or mutual respect of either Appendix of the Cerebel, to wit, of the anterior, which are the orbicular Prominences; and the posterior, viz. the Annular Protuberance: Also of the remaining portion of the oblong Marrow continued into the Spinal Marrow.

BESIDES the aforesaid Nerves, to wit, the fourth, fifth, sixth, seventh, and eighth pair which are employed for the performing the tacit Edicts of the Cerebel for every involuntary Function, and those equal in number to the rest subject to the Brain, that cause the Cerebel to have an Empire divided with it; there are also some Processes and Protuberances, which being placed before and behind the Cerebel, are its Appendixes, that are taken into part of the same Office and Ministry. The description and use of these, are already particularly delivered. But for that (as a while since we intimated) there happens a certain respect or habit between the orbicular Prominences, which is the anterior Appendix of the Cerebel, and the annular Protuberance, which is the other posterior Appendix of the same, and that one part is proportionate to the magnitude of the other; so as when the natiform Prominences are greater or greatest, the annular Protuberance is always smaller or smallest; and on the contrary, they who have this latter in a very great bulk, in them the other is lesser; and so for that either part seems to be a peculiar Repository of the Spirits, which belong to the œconomy of the Cerebel, when a greater provision of them is laid up in one Store-house, therefore there resides a lesser in the other; when I say there is this kind of constant relation found between these parts, it yet remains for us to find out for what end this is so constituted.

Seeing that the animal Spirits are disposed within the several parts of the Head in distinct Schemes of Rays, through which are variously transmitted, as through Perspective-glasses, the impressions of sensible things and the instincts of motions to be performed; it easily occurs, that there are commerces had this way and that way in the natiform Prominences between the Brain and Cerebel; and that the Spirits inhabiting the annular Protuberance are *Internuncii* or Messengers going between, which transfer the mutual respects of the *Præcordia* and *Viscera*, as also of the parts that are wont to be pathetically moved. But if it be inquired into, what kind of commerces and respects those are which the Brain carries to the Cerebel, and on the contrary, and that either have to the Organs of the vital and merely natural Function, we shall in so difficult and very intricate a matter propose our Opinion, though with an hesitating and doubtful mind.

We have before intimated, that the orbicular Prominences did deliver to the Cerebel the forces of the Passions to be carried from the Brain to the *Præcordia*, and did receive from it, and communicate to the Brain the necessities of the natural Instincts delivered from the *Præcordia* and *Viscera* to the Cerebel. To these moreover we add, that the annular Protuberance serves wholly for the same offices, though after another manner; to wit, this receives the forces of the Passions, as it were at a second hand, from the Deputiship of the Cerebel, and transfers them then immediately to

the *Præcordia*; and this seems to be the chiefest office of this part. Further, the same Ring receives immediately the natural Instincts from the *Viscera* of the middle and lowest Belly, and impresses them on the Cerebel to be conveyed further to the Brain; which kind of use it exhibits secundarily by affording only a way of passage: For indeed such Instincts having past through the Cerebel, we suppose to be formed and perfected within the orbicular Prominences, from whence being transmitted into the Brain, they draw forth requisite actions without the previous knowledge of it, or intention of doing.

Hence it may be supposed, that the annular Protuberance contains chiefly the animal Spirits which perform the intestine commotions of the Affections. In every violent passion of the Soul, presently the *Præcordia* are greatly troubled, to wit, the same being variously drawn together or spread abroad, compel the blood into divers fluctuations; but indeed a great company of the Spirits, somewhere got together and ready for Excursions in a set Battel, do perform these disorders and irregular motions of the *Præcordia*; and for that the Spirits can be disposed for this in no other part than here, before the beginnings of the Nerves, constituted for these offices; therefore this Protuberance in a man, by reason of the ragings of the Passions to be performed by a certain force and incitation, is far greater than in any other Animal. For as he is wont to be suddenly and vehemently disturbed, therefore the Promptuary or Store-house is required to be more large, in which a greater plenty of Spirits may be kept, to be bestowed on such inordinations of the Affections. Next to a man this part is greatest in a Dog, Cat, and Fox; in a Calf, Sheep, Goat, Hare, and other milder Animals it is very small.

But as the annular Protuberance seems to be the chief Organ or Chest of the Spirits, from whence the winds of the Passions, destinated for the exciting the *Præcordia*, are conveyed into the breast; so we suppose the orbicular Prominences to be a means of passage, and the very instruments whereby the instincts and necessities of the *Præcordia* and *Viscera* are communicated from the Cerebel to the Brain. Yea, the animal Spirits dwelling in this, as a retiring place, do not only transmit these kind of Ideas or formal Reasons of the Instincts, but in some measure form and prepare them for the Brain. For when as some brute Animals, whose Brain is not imbued with a previous knowledge or practical habits, chuse and bring forth some spontaneous actions as it were with judgment and deliberation, certainly we may believe the intentions of these kind of acts are suggested from some other place than the Brain, to wit, from the aforesaid Prominences. Wherefore 'tis to be observed, that in some Brutes endued with an indocile or dull Brain, the Buttock-like Prominences are greatest, as may be seen in a Calf, Sheep, Hog, and many others; which Animals, as soon as they are brought to light, presently seek for their food, and what is congruous for them they readily know. But in a Man, a Dog, Fox, and the like, who are more apt to learn and acquire habits, these Prominences are very small; and these Animals being newly born, are furnished only with a rude and imperfect sense; besides, they are found wholly unapt to seek out their food. Upon this Observation (which holds good in most Animals which I have yet happened to dissect) as upon a Basis or foundation I dare build this kind of abstruse Hypothesis concerning the natural Instincts and Affections of the *Præcordia*. For as the living Creatures which are more strong in instinct, as Sheep, Hogs, Oxen, Goats, and other slow and gentler beasts, that are not obnoxious to Passions; are also less docile or apt to learn; and on the contrary, they in whom the Affections are wont to predominate, and who are furnished with a certain wit, (as besides Man, are Dogs, Foxes, and some other hotter Animals) are less powerful in Instinct: and as I have observed in the frequent Dissection of all sorts of Heads, that in those kind of living Creatures, who live rather by Wit than Instinct, the annular Protuberance, placed below the Cerebel, was notably great, and the orbicular Prominences only very small; but in other living Creatures, where the Instinct exceeded the wit, and who were less prone to strong Affections, the orbicular Prominences were very great, and on the contrary, the ringy Protuberance exceeding small: From hence I was forced to think, that the orbicular or natiform Prominences, where they are great, are instead of another or supplementary Brain, and the chief Organs of the natural Instincts; yet so, as these parts also serve for a way or means of passage for the transferring the Passions from the Brain towards the Cerebel and *Præcordia*; and that (as we have already hinted) the greater existency of the annular Protuberance is to contain plenty of Spirits requisite

quisite for the winds of the Passions; yet in the mean time, by a further tending forwards or declination of the Spirits inhabiting this, the Species of the natural Instincts, being sent from the *Præcordia* and *Viscera*, pass through. But however the business is, because nothing can be certainly affirmed, or by demonstration, if this our Opinion please not others, at least it may be pardoned.

There remains not much more to be spoken concerning the Offices and Uses of the Cerebel and its Appendix. Concerning its substance, there is something more worthy taking notice of, to wit, that it very much differs in this respect from the structure of the Brain also, for that its cortical little circles are not founded in the stretched out Marrow, as the convolutions of the Brain; but being deeply cut in, are discontinued in their whole tract: so that the whole System of the Cerebel is as it were a cluster of Grapes compacted closely together; in which, although the Berries be contiguous, yet they remain distinct one from another, and bring forth fissures through the whole thickness of the mass. Yea the outward superficies of the Cerebel consists as it were of very many Tubercles or little Tad-stoles or Puffs which grow together on little stalks; and those stalks pass into greater branches, and they at length being bipartite or twofold, go together into two larger Marrows near the bottom of the Cerebel, in either of which are three distinct medullary Processes: of which threefold processes on either side we have already spoken. But of these concerning the use of the Cerebel in general, we shall yet further advertise you, that as very much of its substance is cortical, it begets animal Spirits in great plenty, to which in the circulating there is not granted, as in the Brain, an equally great space; for that there seems not to be much need of it in the animal Government. For the Spirits so produced in the Cerebel plentifully by a perpetual emanation, ought to flow outwardly for the offices of the natural and vital Function: but more inwardly for the impulses variously sent into them, they admit certain undulations or wavings, by which some occasional acts of the involuntary Function are brought forth, as is shewn before.

But as it is manifest enough, that the animal Spirits are generated within the cortical little circles of the Cerebel, it doth not seem needful that we should ordain their Work-house in the Ventricle subject to its frame. For that Cavity (as we have already shewn) is only an empty space, which lying under its double little foot and medullar Trunk, comes between it and the overlying bunching out of the Cerebel. But indeed there belongs to this besides a certain use, to wit, that the ferous watry heap laid aside out of the Glandula's and infoldings of the Vessels, as also from the substance of the Cerebel, being made over-moist, distilling down, might slide into this Cistern. From whence, lest it should flow down upon the beginnings of the Nerves, by a restraining Membrane it is compelled into the hole of the strait Den lying under the orbicular Prominences; and from thence is received from the declining aperture of the Tunnel, and carried out.

Below the Cerebel, the oblong Marrow going forward with the rest of its tract even to the hole of the hinder part of the Head, ends at length in the spinal Marrow: but in its Trunk, as yet contained within the Skull, besides the Nerves and Processes but now recited, the beginnings of the ninth and tenth pair of Nerves are also radiated. Of which there will be hereafter a proper place to speak, when we shall institute the whole Neurology or the Doctrine of the Nerves. In the mean time, we shall take notice of the beginning of the ninth pair, which is peculiar in Man, and different from what is found in Brutes: To wit, in Man below the origine of the eighth pair, a certain Protuberance grows to either side of the oblong Marrow. Out of that four or five distinct Fibres do come forth; one or two of which binds about the Vertebral Artery passing through it, but all grow together into the same Trunk, which is the Nerve of the aforesaid pair. This Protuberance, the *Pia Mater* being pulled away, may be easily seen, and seems to be the Repository or Store-house of the Spirits destinated to this Nerve.

For as this Nerve is bestowed on the Tongue and its Muscles, and so conduces chiefly to the performing of speech in Man, who hath a greater and more frequent use and exercise of the voice, there seems to be need of a great provision of Spirits, plenty of which ought always to be in a readiness. But in Brutes, who have none, or a rarer necessity of the voice, such a Protuberance is wanting, because it is not required in them that the Spirits should be gathered together by heaps, as it were in a certain Porch, before the Organs of the Voice, but that it may suffice for them to be

be called forth by degrees out of the common tract of the oblong Marrow. Further, whereas some fibres of this Nerve bind about either Vertebral Artery, unless I am deceived, that is so ordained for this end, lest perhaps in speaking, when at any time we are more vehemently moved, the blood being stirred up, might rush upon the Brain with a torrent. For this Nerve binding about the Vertebral Artery, as it were with a bridle, and so as a Moderator not only of the Tongue, but also of the Blood, restrains its more rapid influence. After the same manner, and for no other ends, do the recurrent Nerves, destinated to some part of the same office, variously bind about the Trunk of the great Artery, as shall be shewn afterwards.

As soon as this inferior portion of the oblong Marrow is unclothed from the *Pia Mater*, the pyramidal bodies come in view otherwise lying hid. These in all Animals, endued with the annular Protuberance, are constantly found; also as that Protuberance is bigger, so these bodies appear more noted: but indeed in a Man and a Dog they seem like two large Nerves, which being produced out of that Ring, end over against where the eighth pair arise in sharp points. If the use of these be sought into, it is most likely, that the animal Spirits superabounding in the annular provision or store, do flow out as it were by these Emissaries, which Spirits however run into the beginnings of the eighth pair placed near, and so are bestowed by their proper means on the offices of the involuntary Function.

Although the oblong Marrow retains not its name beyond the limits of the Skull; yet it is the same substance, which from thence being continued further into the cavity and utmost recesses of the whole Spine or Back-bone, is called the Spinal Marrow: but it is brought forth for this, that the Nerves to be distributed into the Limbs and Members more remote from the Head, might more commodiously arise out of the same medullar substance stretched out into the neighbourhood of every part. Indeed all this whole medullar Trunk, which is continued from the bottom of the Brain even to the *Os sacrum*, seems like the Pneumatick Chest, or Bellows of a pair of Organs, which includes the blast or breath destinated to every Pipe; for in like manner the animal Spirits are contained in this marrowy tract, which blow up and actuate all the Nerves hanging thereto, as occasion serves.

If you behold the origine of the whole, it seems that the whole frame both of this oblong Marrow and the spinal, is of a medullar or marrowy substance, every where growing dispersedly through the Brain and Cerebel, and then being gathered more round together in the middle of either, becomes as one heap. For the Marrows besmearing all their folds and turnings about, are as so many little rivers, which springing from thence, begin to be congregated in the middle, and to be poured out in one great one; but being from thence united, they make the oblong Marrow, as it were the chanel of the Sea, big enough for the motion or ebbing and flowing and reciprocation of the animal Spirits: which belly or chanel, however stretching it self further beyond the Skull, is increased into the spinal Marrow, as it were the bosom or process of the former.

But as the medullar tracts, besmearing the folds and convolutions of the Brain and Cerebel, unfold themselves into their middle Marrows and medullar Trunk, and so the Spirits springing dispersedly from their first fountains, congregate as it were into a certain diffused Sea; so from this Sea, causing an ebbing and flowing, or a continual or very frequent influence of the animal Spirit, the same Spirits flow out into the depending chanel of the nervous System.

Concerning this part of this Marrow, which being included in the long bosom or chanel of the *Vertebrae* or Back-bone, and according to all their joyntings, being marked with as it were knotty processes, is called the Spinal, there occur not many things worthy consideration, besides what are commonly known. The figure, situation, as also the body of this, in its whole tract, are known generally to be cloven in two, not only by Anatomists, but by every Butcher. The ramifications or branchings of the Nerves, proceeding from the spinal Marrow, are delivered hereafter. Concerning its conformation something peculiar occurs. For as the spinal Marrow is as it were the common passage or chanel of the Spirits flowing out of the Head into the Nerves, it may be observed, that this chanel, not after the usual manner of other passages, where many rivers flow in, doth swell up more; but on the contrary, in what place it hath more and greater Emissaries, its magnitude is increased; for in those parts of the spinal Marrow, out of which the brachial and crural Nerves arise, (or those Nerves belonging to the Arms and Legs, whose beginnings are more and larger) its

its Trunk becomes much thicker than in the rest of the frame or substance. The reason of this is, because within the medullar tracts the animal Spirits run not, nor pass through with so swift a passage, but for the most part flowing leisurely from their Fountains, when they have filled the whole space, they stay therein; and as many Spirits, upon occasion offered, are wont to be bestowed on every work; those remaining there in readiness frame certain convenient Promptuaries where they may divert themselves. Wherefore we ordinarily observe, not only of this Marrow, but of the Nerves themselves, that as often as a small branch is distributed into many shoots or suckers to be sent forth here and there, always in the very knot of the division there grows a far greater fold than in the rest of the Trunk of the Nerve; so that 'tis a wonder from whence the Nerve should acquire so in the middle of its passage a new substance and more ample bulk. But of these things and others belonging to the Doctrine of the Nerves, it behoves us to discourse in the following Chapters.

C H A P. XIX.

Of the Nervous System in general, where its parts (which are the Nerves and Fibres) being designed, a prospect of the whole Animal Government is exhibited.

WHENAS hitherto having beheld the several Regions of the Brain it self, the Cerebel, and medullar Appendix, and the provision and offices of them all, we have designed or drawn forth the uses and employments also of the parts and processes, and the sanguiferous Vessels belonging to every one of these; it is now time for me to stop and retire into the Port from this troublesome and intricate Sea of Disquisition: But indeed, because I find that I have not yet reached to the farthest shores and utmost parts; but that beyond this Sea, which we have sailed through, as yet the nervous System, and very many Creeks or Bosoms, Meanders, and highly intricate Recesses or private places in it remain to be viewed; therefore although we know it is difficult to proceed with full Sail, we have resolved to undertake the task of the Doctrine of the Nerves; and the rather, because without the perfect knowledge of the Nerves the Doctrine of the Brain and its Appendix would be left wholly lame and imperfect; for neither what hath already been delivered concerning them can be sufficiently understood or illustrated, nor (which I chiefly desire, and is the end of the former Disquisitions) without those things before known can the Pathology of the Brain and nervous stock be rightly instituted. And indeed there are many things which might easily deter any one from such an undertaking: to wit, the hardness of the work, and full of hazard; which promises at first sight more difficulty and thorny labour, than pleasure or profit. Then some will object, that this Province is already so perfectly cultivated, and adorned by former Anatomists, that by a repetition of the same, I may seem to have meddled with a thing done to my hand. But I may readily answer to these, first, That the Anatomy of the Nerves yields more pleasant and profitable Speculations, than the Theory of any parts besides in the animated Body: for from hence the true and genuine Reasons are drawn of very many Actions and Passions that are wont to happen in our Body, which otherwise seem most difficult and unexplicable; and no less from this Fountain the hidden Causes of Diseases and their Symptoms, which commonly are ascribed to the Incantations of Witches, may be found out and clearly laid open. But as to our Observations about the Nerves, from our following Discourse it will plainly appear, that I have not trod the paths or footsteps of others, nor repeated what hath been before told.

Therefore that according to our determination we may enter upon the explanation of the nervous System, we shall comprehend under this name all parts, upon which gifted with the animal Spirit, Motion and Sense necessarily and immediately depend, to wit, for the performing either one only, or both together in the whole Body. But these kind of parts, in respect of the Head and marrowy Appendix, are like a branching stock or imps growing out of the trunk of a Tree: for supposing that the

the cortical substances of the Brain and Cerebel are in the place of roots, and that the substances every where medullar are taken for the stock or pith; the nervous germination or budding forth expanded into divarications of Nerves and Fibres, will appear like so many little branches, twigs, and leaves. Or if the Head containing in it self the chief part and power of the sensitive Soul, be taken for the body of some Luminary, as of the Sun or a Star; the nervous System shall be that radiant or beamy concretion compassing it about. Because the animal Spirits flowing from the Brain and Cerebel, with the medullar Appendix of either, as it were from a double Luminary, irradiate the nervous System, and so constitute its several parts, the Organs of Motion or Sense, or of both together, as hath been said.

The parts of the nervous System, as a radiant or beamy texture, are either primary, *viz.* the bodies themselves of the Nerves, into which the animal Spirits immediately flow from the Head and its medullar Appendix; or secondarily, which are Fibres planted or interwoven in the Membranes, musculous Flesh, Tendons, and some of the Parenchyma, which also contain in themselves animal Spirits; but they receive them not but mediately and secondarily derived from the Head through the bodies of the Nerves.

We have already shewed that the animal Spirits are procreated only in the Brain and Cerebel, from which they continually springing forth, inspire and fill full the medullar Trunk: (like the Chest of a musical Organ, which receives the wind to be blown into all the Pipes) but those Spirits being carried from thence into the Nerves, as into so many Pipes hanging to the same, blow them up and actuate them with a full influence; then what flow over or abound from the Nerves, enter the Fibres diffused every where in the Membranes, Muscles, and other parts, and so impart to those bodies, in which the nervous Fibres are interwoven, a motive and sensitive or feeling force. And these Spirits of every part are called Implanted, forasmuch as they flow not within the Nerves, as the former, with a perpetual flood; but being something more stable and constant, stay longer in the subject bodies; and only as occasion serves, *viz.* according to the impressions inwardly received from the Nerves, or impressed outwardly by the objects, are ordained into divers stretchings or carryings out for the effecting of motion or sense either of this or that manner or kind.

Indeed the animal Spirits flowing within the Nerves with a living Spring, like Rivers from a perpetual Fountain, do not stagnate or stand still; but sliding forth with a continual course, are ever supplied and kept full with a new influence from the Fountain. In the mean time, the Spirits in the rest of the nervous kind, especially those abounding in the Membranes and musculous stock, are like Ponds and Lakes of Waters lately diffused from the chanel of Rivers, whose waters standing still are not much moved of their own accord; but being agitated by things cast into them, or by the blasts of winds, conceive divers sorts of fluctuations.

But because there is no light difference between the motions and consistency of the Spirits and of Waters, perhaps it will better illustrate the matter, if the Spirits of either kind, to wit, the inflowing and implanted, are compared to the beaming forth of divers rays of light. And so when light is let into a dark chamber, and presently inlightens the whole, we may conceive the particles of the light so swiftly diffused to be of a twofold kind; to wit, some are bodies sent from the light it self, which diffuse themselves every way into an Orb; and other luminous particles are as it were Etherial little bodies existing before in the pores of the Air, which being agitated by the former, and as it were inkindled, cause as it were a flamy, though most thin contexture, stretched out in the whole clearness. After the like manner, the animal Spirits flowing from the medullar substance into the Nerves, are as it were rays diffused from the light it self, and the other Spirits every where abounding in the Fibres, are as so many lucid particles included and implanted in the Air, which are actuated by the former, and being stirred up by them into motion, perform the acts both of the sensitive and locomotive Faculty.

That it may the better appear by what means the animal Spirits do irradiate and swiftly pass through the parts of the nervous System, both primary and secondary; so that light is scarcely carried swifter through a diaphanous Medium, than the communication of the Spirits is made from one end of the nervous System to the other; it will be requisite to inquire here a little concerning the Origine of the Nerves and nervous Fibres, also of their Fabrick and Conformation, to wit, what pores and passages either of these bodies have, and how disposed for the passing through and commerce of the animal Spirits.

As

As to the Nerves, it is manifest from what hath been said, that all of them are produced immediately out of the medullar Trunk or its processes; so that as these parts are the common and broad roads which lead both from the Brain and from the Cerebel, all the Nerves are particular paths reaching out from them on every side into the several Regions of the animated Body. Wherefore the same Marrow, which is the original of every Nerve or Sinew, forasmuch as it is drawn into a more thin thread, constitutes the matter of the same Nerve; which indeed, that it may be made more solid and compact, is cloathed with a peculiar production of the *Pia Mater*: for as from a Silver mass gilt or enriched with Gold, all the threads produced from it are gilded; so the same Membrane, which covers the medullar Trunk, is produced together with all the Nerves coming out from the same, and cloathes them all. Further, very many Nerves arising together out of that marrowy beginning, go forth as it were by bands; which notwithstanding, for the sake of the better passage, being presently united and carried out of their bony Cloister, are included in a common Coat taken from the *Dura Mater*. For we suppose (which also shall be more clearly shewed anon) that all the Nerves, destinated to any parts or every particular member, do arise distinctly and apart, and so remain in their whole passage. But in that oftentimes a Nerve appearing as it were one Trunk, afterwards seems to go into many branches, it is because those branches being indeed singular, and divided in the whole passage, are collected as it were into one bundle; for sometimes we have separated those Nerves, seeming to grow together as it were into one rope or cord of a Nerve, one from another, dividing them to their very original; for neither otherwise could the Instincts of the Motions to be performed be carried so respectively to these or those parts, separate one from another, to which the branches of the same Trunk belong.

The passages of the Nerves are not bored through as the Veins and Arteries; for the substance of those are not only impervious to any Bodkin, but no cavity can be seen in them, no not by the help of Spectacles or a Microscope. As to what belongs to the smelling little Pipes, they seem to be so made, not for the passage of the animal Spirits, but that some ferocities might slide down that way: but the Spirits themselves are carried in the sides, and not in the cavity of either Pipe; but the substance of the other Nerves appears plainly firm and compacted, that the subtil humor, which is the Vehicle of the Spirits, may pass through their frames or substances, even as the spirits of Wine, the extended strings of a Lute, only by creeping leisurely through. Hence it may be argued, that because the animal Spirits require no manifest cavity within the Nerves for their expansion; neither is there need of the like for them within the substance of the Brain; but that the Ventricles, commonly so called, ought to be deputed to some other office than this.

But the Nerves are white, smooth, and round bodies: within the Skull and nigh their beginnings, being as it were only covered with the *Pia Mater*, they are soft and easily broken; without this, for that many of them are for the most part gathered together, and also cloathed with the *Dura Mater*, they become somewhat hard and more tenacious. The Nerves themselves (as may be discovered by the help of a Microcosm or Perspective-glass) are furnished throughout with pores and passages, as it were so many little holes in a Honey-comb, thickly set, made hollow, and contiguous one by another; so the Tube-like substance of them, like an *Indian Cane*, is every where porous and pervious. Within these little spaces the animal Spirits or very subtil little Bodies, and of their own nature ever in a readiness for motion, do gently flow; to which is joyned, both for a Vehicle, as also for a Bridle or stay, a watry Latex, and that it self of very subtil parts. This Humor diffuses with its fluidity the Spirits through the whole nervous System; also by its viscosity retains them, that they be not wholly dissipated, but as it were in a certain *Systasis* and continued Series; for it seems, that without such an Humor the Spirits could not consist within the nervous stock, but they would vanish away into Air. Further, the same Humor is no less required for the passing through of the sensible Species: because the animal Spirits, we suppose, like the rays of Light, to be diffused through the whole nervous System; and those rays, unless the humid particles of the Air be mingled with them, do not easily transmit the forms or images of things; as is obvious in an Optick Scene, which is hid or shadowed by the clear beams or brightness of the Sun. And in like manner, from the defect or depravation of the nervous Juyce, we can readily shew, that the inordinations of the animal Spirits, and oftentimes most horrid distempers of the Brain and the nervous stock do arise.

This nervous Juyce being derived from the Brain and Cerebel into the medullar Appendix, is carried from thence by a gentle sliding down through the Nerves even into the whole nervous stock, and waters its whole System. Upon the equal emanation of this depends the expansion of the animal Spirits through the whole; and the substance of these, yea the Hypostasis of the sensitive Soul it self is founded on the diffusion of the same humor. The animal Spirits being left to themselves, follow the motion of this Juyce, and flowing together with it in the same course, are pleasingly or quietly expatiated; but in the mean time, as occasion is offered, the same Spirits, as a breath moving upon those waters, conceive other spreadings abroad, and those more rapid. For as in a River, from winds or any thing cast in, divers undulations or wavings are stirred up; so the animal Spirits being raised up by objects for the performing the offices of sense and motion, do tend this way or that way to and fro within the nervous stock, and are agitated hither and thither by other means.

But to return to the parts of the nervous System, besides the Nerves themselves, Fibres also being dispersedly interwoven in the Membranes, the musculous Flesh, the Parenchyma, and other parts, and united in the Tendons, are the Organs of sense and motion. Yea, the acts of their faculties are principally and more immediately executed by the Fibres than the Nerves; for they, by drawing together the Muscle and other motive parts, cause the motion it self; but the Nerves only carry from the Head the instinct for the performing of that motion. In like manner, in Sensation the Fibres receive first of all and immediately the impressions of sensible things, and express the same (as musical strings do the strikings of a quill or fingers) by an intrinsecal modification of the Particles, and represent the various approaches of the object by the like motion of the Fibrils, as by a moveable and fluid Character, whose Idea the Nerves transfer only to the Head.

Concerning the nervous Fibres it behoves us to inquire from whence they have their rise? For it appears plainly, that they arise not immediately from the Head or its medullar Appendix; nor is it less improbable, that they are produced (as 'tis commonly said) from the Nerves: because what is asserted, that the Fibres are productions of the Nerves, and little bits or pieces of them torn off, as it were into hairy branches, seems unlikely; for that the Fibres in some parts, being placed nigh, exceed in their bulk the magnitude of the Nerve that is brought to that part, at least an hundred-fold: which thing appears clearly from the Tendon of every Muscle, which being made up of united Fibres, is observed to be far greater than the Nerve inserted to it. And indeed for almost the like reason we are induced to think the nervous Humor it self also, whereby the Membranes and musculous Fibres are wont to be watered, to be derived unto them not by the only means and passage of the Nerves; because it is heaped up much more plentifully and in more abundance than can be carried thither through those narrow passages, as appears clearly in Ulcers of the Kings Evil, or in Impostumes or Wounds of the Tendons and nervous parts, in which a glutinous Humor drops forth in so great abundance, that all the Nerves of the whole Body could scarce be able to supply it.

Wherefore concerning these, it seems that we may affirm, that the Fibres are not continued portions of the Nerves broken off into little hairy strings or Capillaments; and that all the Fibres originally proceed not from the Nerves, because some of them, viz. those interwoven to the Heart and its Vessels are of equal birth with the Nerves themselves, and coexist with them together from the beginning. However most Fibres, as to their production, depend upon the Nerves; and all, which way soever brought forth, receive constantly from the Nerves the forces and supplements of the animal Spirits, and also the Instincts of the Motions to be performed by them.

Therefore to recount the births or kinds of Fibres; they are first either spermatick and first begotten, the rudiments or first beginnings of which being of the like antiquity as the Heart and Brain, placed in the Conception, afterwards leisurely increase; to wit, such are, as hath been said, those in the Heart it self in its depending Vessels, the Membranes and some other parts, which form the first stuff or threads of the Embryo: or secondly, other Fibres are produced secundarily, and by a second birth; of which sort chiefly are such which are interwoven into the parts taken for the compleating of the animal Fabrick, and especially those termed Sanguineous, which we think to be begotten after this manner.

The Heart and Brain, with the Arteries and Nerves hanging to them, are primitive parts, and highly original; but these, for the second birth of others, and

for the nutrition and increase of all the sensitive parts, distribute a twofold humor : *viz.* one spirituous and endued with very active Particles which perpetually flow, though but in a very small quantity, through the passages of the Nerves from the Brain and Cerebel ; and the other flow and softer, which being every where laid aside through the Arteries from the bloody mass, is rendred more plentifully. This latter being of it self dull and thicker by much, is actuated by the former, and being imbued by it, as by a certain Ferment, acquires strength and power of growth or vegetation. But indeed the nervous Juyce, forasmuch as it diffuses with it self the animal Spirits, imparts to every part, besides the faculties of Motion and Sense, the determinations also of form and figure. Further, whilst that, being joyned to the other arterious humor, is disposed into the substance and matter of the member or part to be nourished, it forms some tracts as it were, to wit, the Fibres themselves, in which the animal Spirits, coming together with them, reside and are expatiated. These twofold or twin humors, coupling together in every sensitive part, constitute a liquor truly nutritious, to wit, which is both spirituous and nourishable. And in truth, both these Juyces, *viz.* the nervous and arterious, being married together, are as it were the male and female seed, which being mingled in a fruitful womb, produces the plastick Humor, by whose virtue the living creature is formed and increases. Hence may be observed, as the particles of the spirituous liquor, or of the other more watry juyce (*viz.* this latter being supplied from the Arteries, or that from the Nerves) are strong or excel, as to their properties or powers, all living creatures become more or less nimble, active, and ready to any motion and labour. Besides, from the default or depravation of the one and the other humor excelling, the sorts or kinds of this or that disease are excited ; concerning which, and also what belongs to the explication of the nutritious Humor, we may perhaps have some other time occasion to discourse.

The animal Spirits which enter and fill the ordained series of the Fibres as so many little places, flow thither by the passages of the Nerves ; notwithstanding the Spirits which are seated in the Fibres, interwoven with the musculous stock, receive nourishment, yea and as it were auxiliary forces, from the arterious blood there plentifully flowing : whereby indeed both the Spirits themselves acquire for the performing of Motions a greater force and as it were elastick ; so that their force being stirred up by a strong endeavour, it seems like the explosion of Gun-powder ; and also the same Spirits being continually consumed within the Muscles more profusely than is wont to be in the Membranes and other parts, are in some measure made up or repaired from the bloody sustenance : because whenas the arterious Juyce joyns more plentifully with the nervous flowing within the sanguineous parts, it may be well thought, that it also lays upon the Spirits brought thither with it, as it were some nitrosulphureous particles, and intimately fixes them on them ; and so, by reason of this Copula, highly flatuous and apt to be rarified, the Spirits themselves become there more active, so that in every motive endeavour, whereby the Muscle is suddenly intumefied, they, as if inkindled, are exploded. Moreover, a sudden reflection of the consumed or wasted Spirits, after great exercise or labour, is for this reason also performed by the blood ; for that the spirituous particles being left and forsaken by motion, presently a new Copula of the same kind of matter, apt for explosion, is joyned to them. For it is not possible, that the immense loss of Spirits which happens in hard labours (if they were wholly destroyed) in so short a time, should be able to be restored by supplements coming only through the Nerves. We shall discourse more largely of these things, if at any time hereafter we shall treat of the Motions of the Muscles.

The animal Spirits being disposed within the several Muscles, according to the series of Fibres, seem as it were so many distinct Troops or Companies of Souldiers ; all which being set as it were in a Watch-tower, are ordained, as a new impression is carried to them by the Nerves, either from the objects outwardly, or more inwardly from the Head, forthwith into various forms and peculiar orders for the performing of motion or sense of this or that kind. The carriage or behaviour of these is worth the seeing in an animal newly killed and its skin taken off. For when life perishes, and all the force of the Spirits flowing in through the Nerves hath quite ceased ; yet the Spirits implanted into the whole Body breaking forth from the Muscles, still move and shake them, and force them into several Convulsions and trembling motions.

From what hath been said we may gather, what the disposition or order of the

animal Spirits may be in the whole animal Body : to wit, those procreated in the cortical substance both of the Brain and Cerebel, are congregated into the middles of either, as it were into distinct Empories or Marts ; and an expansion being made in either, they cause certain interior powers of the sensitive Soul to be exercised ; yet the same Spirits, affecting more room, enter the oblong Marrow (as it were the Chest, as hath been said, of a musical Organ) and fill it full ; within which flowing, they carry to and fro the impressions of sensible Things and the Instincts of Motions. From the oblong and spinal Marrow the same Spirits, unless when they are otherwise busied, tending outwardly, flow towards the several parts of the whole Body ; which notwithstanding wandering so out of doors, because they pass through very strait ways in their passage, to wit, the slender bodies of the Nerves, they break not forth in heaps, or in a thick troop, but only contracted orderly, and as it were by bands or divisions : but they being carried beyond the extremities of the Nerves, and there possessing the Membranes, Muscles, and other sensible parts, dilate themselves as it were into a most ample field, and with a very diffuse Army they dwell in the Pores and passages of the Fibres planted every where about ; where also being endowed from the blood with new food, they become more lively and more expeditious or ready for the designed offices.

Here perhaps it may be demanded, how the animal Spirits, diffused in such numerous troops through the habit of the Body, are able to be supplied by so strait chanelles of the Nerves ? To which we reply, That those which reside more outwardly do not quickly evaporate, nor are remanded back by Circulation : wherefore when all the Fibres are filled by an influx of the Spirits made by little and little from the beginning, very small supplements suffice to repair their expence : For neither are those dwelling more outwardly, for that they are repaired by the bloody food, much consumed, though in frequent action.

Hence may be noted the difference between the distributions of the blood and animal Spirits. That *Latex*, because it is reduced in a circle, its Vessels are in the whole passage proportionated as to the bulk of the Trunk and the branchings sent from it, to wit, so that the branches of the great Artery, being carried from the Heart, contain at the least so much of the blood, as the shoots reaching forth from them, into all the parts. But because the animal Spirits, being once begotten and carried more outwardly, subsist longer there, and evaporate very slowly and by little and little ; therefore the Vessels carrying them, *viz.* the Nerves, in respect of the Fibres receiving them, are made much lesser in proportion ; lest perhaps by too great a supplement of the animal Spirits, and the too thick gathering of the fresh ones still into the nervous parts, the Army of the Veterans, before instructed, should be confounded, and so the orders of all being disturbed, the exercises of the animal Function should be performed any how. For indeed when at any time the Spirits are made too sharp, so that being therefore struck as it were with madness, they rush upon the nervous System with tumult and impetuosity ; from thence a great unquietness and continual throwing about of the Members are wont to be excited, to which sometimes madness and fury succeed.

In the order and ordination of the animal Spirits, such as was but now described, the *Hypostasis* or the Essence of the sensitive Soul consists, to wit, which is only a certain *Systasis* or shadowy subsistence of those Spirits, which like Atoms or subtil Particles, being chained and adhering mutually one to another, are figured together in a certain Species. Moreover, the faculties of the same Soul depend upon the various *Metathesis* and gesticulation of those Spirits within the aforesaid Organs of the Head and nervous System. But the consideration of this Soul and its powers requires a peculiar Tract, which hereafter (God willing) we intend ; in the mean time, our Method demands of us, that (according to our weak skill) by the cense or numbering of the Nerves, being particularly made, we should deliver an exact Neurology or Doctrine of the Nerves.

But for that in the premised general consideration of the Nerves and Fibres, there was mention made of the nervous and nutritious Juyce ; notwithstanding what belongs to their powers and natures, hath been neither fully nor clearly enough delivered ; therefore we will a little divert here, and make it our business to inquire what sort of Juyces and Humors are carried into the parts of the animated body for their nourishment, and by what ways or passages : then this difficulty being removed, a plain and easie way leads into the Doctrine of the Nerves.

C H A P. XX.

*Of the Nervous Liquor, and whether that or the bloody Humor
be Nutritious.*

SINCE the Circulation of the Blood was made known, and it hath been plainly made appear, that it did no where stagnate and stand still long, but was carried in a reciprocal motion, always as in a circle; it began to grow doubtful, whether its *Latex* is nutritious or not. For besides, that the more rapid course of the blood, as of a torrent, might seem to wear the banks which it flowed between, and to carry away some Particles from them, rather than to be able to affix any thing to them; the substance it self also of the blood, for that it is more torrid and uneven, is thought to be altogether unfit for nutrition. Wherefore that a Juyce may be found more convenient or fit for this office, the passages and hidden recesses of the Nerves are to be viewed; and as a certain *Latex* is found to flow within their Pores and passages, presently the blood being rejected, that nervous humor is gifted with the title of nutritious: but yet by what right, and after what manner nutrition is performed, shall be our present purpose to inquire.

And here first of all, that we may take the part of the blood, it will be easie to shew, that there is matter contained in it fit enough for the nourishment of the body, and a sufficient store of it. For besides the sulphureous substance of the blood, which within the fire-place of the Heart, with a continual inkindling, and by that means deflagration in the Vessels produces life, and in the more perfect Animals heat, there is found also a certain other humor soft and alible, which in the Circulation, being distributed through several parts of the Body, by increasing them adds nourishment and bulk: yea the deflagration it self of the blood, plainly as a Kitchen-fire in dressing meat, as it were boils and prepares this humor, whereby it more easily is assimilated into the substance of every part to be nourished. Hence it comes to pass, that by reason of a defect of heat in the blood, no less than of excess, nutrition is often hindered. But that this kind of alible Juyce is contained in the bloody mass, the *Anatomy* or spontaneous *Analysis* of its *Latex* sufficiently declares; for the extravasated blood, when it goes into parts of its own accord, this liquor being disjoyned from the purple thick part, and swimming a-top of it, appears clear or limpid; but by reason of its more thick contents, to wit, the nutritious Particles, like the white of an Egg, it is easily made thick, and grows white by a gentle heat: which thing appears by this familiar Experiment, to wit, if you shall evaporate a little of it only in a Skillet over the fire, the whole liquor will presently grow together into a white Gelly. By this liquor, as the blood is more or less imbued with it, living Creatures grow and become more fleshy or lean: for both the blood of younger Animals being loosned from cold, is wont to shew much more of this kind of white than more ancient or older Creatures; and we may take notice daily at our Tables, that very much of this kind of Gelly comes out of the flesh of a Lamb or Calf being boiled or roasted, and nothing almost from Mutton or Beef, especially if old. Therefore we may lawfully suppose, that the blood is truly nourishable; and that the whole, or at least the greatest part of the matter, for the adding bulk or substance to every part, is dispensed from it: but if at any time it be defective in this its office, that happens not out of the natural unfitness of it, but because its disposition is sometimes depraved, and as the Stomach labouring with some vice, rejects or perverts the Chyle to be cooked by it.

But the blood, as it is not the only and alone humor, which is distributed in the animated Body, so neither seems it able to perform alone and of it self the whole office of nutrition. For besides that, being diffused through the Arteries and Veins, another *Latex* is every where dispensed from the Head through the Nerves; which shall be shewn to afford something at least to nourishment.

As to the first, there are many reasons which declare that kind of humor to be in the Brain and nervous stock, and to abound in their whole passages. For unless the animal Spirits, continually flowing out, should be founded in such a *Latex*, which is their Vehicle, they would not be contiguous or joyned, nor able to continue and

knit together the *Systasis* of the sensitive Soul. For if *Hippocrates* did observe long since, that Cramps and Convulsive motions were produced from driness and emptiness, that perhaps might happen by this means: to wit; because the humor in the Nerves or Fibres being deficient, the Spirits distracted one from another, were separated; which notwithstanding, that they might still retain their mutual embraces, and as it were folding of hands, bend the containing bodies, and very much contract, and so force them into Convulsions. Besides, Wounds and Impostumes of the Tendons and nervous parts seem to witness the diffusion of the nervous Juyce, either of which drop forth a thin Ichor, and wholly unlike to the mere bloody Excretion: no less may be argued from the Ganglia and Evil running Sores. In time of sleeping the aforesaid humor is wont to flow more plentifully into the Brain and Nerves, and to obstruct their passages; and therefore yawnings and stretchings come frequently upon those awaking, that its reliques might be shook off. Lastly, we might readily shew, that from the depravation of the nervous humor, Melancholy, Madness, and some wonderful Convulsive distempers proceed. But it may be objected, that there is no such kind of humor, because the Nerves being cut asunder, it is not perceived to flow out; and that the Nerves being also bound, they do not swell above the Ligature, as Arteries and Veins. But it may be answered, That the liquor flowing in the nervous stock, is very subtil and spirituous, and which, by any striving or wrinking up of those parts, when they are roughly handled, may easily evaporate and be blown away or dispersed unperceivably. Then further, 'tis observed in the Whelps of some Animals newly litter'd, who have as yet that juyce viscous, and not easily to be dispersed, and that have their Nerves greater, if they be bound hard together with cords, they will swell above the Ligature.

Therefore seeing it appears, that a certain Humor doth creep through the blind Pipes and passages of the Head and of the Appendix, both medullar and nervous, it behoves us next of all to inquire from whence that comes thither, and whither it tends; and lastly, of what kind of nature and use it is. Concerning these first it appears, from what hath been said, that the aforesaid Latex, serving for a Vehicle of the animal Spirits, is perpetually instilled, together with them, from the blood watering the exterior confines of the Brain and Cerebel, which from thence, passing through the medullar Trunk, is afterwards, with a gentle spring, poured through the whole frame of the nervous System; so that the first fountains of the nervous humor are in the Brain and Cerebel. But further, to this Juyce conveying the forces of the animal Spirits, and supplied only from the Head, there joyns a certain other humor, as it were auxiliar in the whole passage, and restores and refreshes it otherwise about to grow deficient.

We think that these kind of supplements and subsidies, which happen to come from elsewhere to the nervous Juyce flowing from the Head, are received and admitted inwardly from the sides and extremities of the medullar and nervous System. We have already shewed that an humor, as it were secondary, is instilled from the blood watering these parts in its whole passage; because the Arteries follow not only the medullar Trunk, but also the greater Trunks of the Nerves in many places, and insert into them sanguiferous shoots. Besides, forasmuch as the animal Spirits flowing within the nervous stock for the performing of sense and motion, tend to and fro, and so bear a double aspect; it is probable also, that the liquor watering the Nerves, as it most commonly tends forward, so sometimes backward; and so that the extremities of the Nerves, implanted in some parts, imbibe from them the humor, at least some Effluvia's, with which they are satisfied, and oftentimes transfer them into the Brain it self. Certainly there is no doubt, that the Fibres and nervous Filaments or threads which cover the Sensory of taste, and the *Viscera* serving for Concoction, do immediately receive some tastes of the taken in food, from which supplies are carried to the Brain it self in great hunger and faintness of Spirits. Because if at any time the Spirits inhabiting it, being exhausted very much with heavy and long labour, begin to fail, a most swift refection is performed, Pectorals or Cordials being scarcely swallowed, and long indeed before the alible Juyce can be able to reach to the border of the Brain by the passage of the blood. Moreover it is most likely, that not only the benign Effluvia's of the aliment are received by the extremities of the Nerves ending about the *Viscera*; but also by this way, that oftentimes an infectious matter, and in a manner malignant, is communicated by the Nerves and their passages to the Head. But indeed the preternatural Juyces heaped up about the

the Hypochondria, the Spleen, Womb, and other Bowels emit vaporous little bodies, which not only infect the bloody mass, and distemper the Head by that means, but they climb to the Brain more immediately by the passage of the Nerves, and strike it with an heavy ill. For from hence in part it comes, that Hypochondriacks and Hysterical people are so cruelly punished through the Symptoms stirred up in the Brain and nervous stock for the faults of the lower Bowels; hence it is, that little Pills of Opium, being scarcely dissolved in the Stomach, cause a Torpor or heaviness. But here is no place to discourse more largely of these. It behoves us to consider what remains, the Springs of the nervous Juyce, the Auxiliaries but now detected, and its Virtues and Influences.

Concerning the nervous Liquor we shall inquire what that doth in its passage, to wit, whilst it flows within the Marrows or middles of the Brain and Cerebel, the medullar Trunk and the bodies themselves of the Nerves: secondly, then for what uses it serves, when being slid from the ends of the Nerves, it is spread abroad on the secondary parts of the nervous System.

1. As to the first, whilst that of the nervous Liquor passes through the Head; and either of its Appendix, its chief office seems to be for a Vehicle of the animal Spirits, which indeed it carries along with its diffusion, and contains them under the same *Systasis*. Yea, this Latex shews various Schemes of the Spirits for the performing of sense and motion; even as the humid Particles of the Air pass through the Optick Configurations of the Rays of Light. Also moreover, the nutrition of the aforesaid parts and accretion or growth into a greater bulk, depends in some measure upon the nervous Juyce watering the same, as shall be shewed by and by.

2. But the greatest question is concerning this Liquor being diffused beyond the ends of the Nerves upon the secondary parts of the nervous System, and in the passages of them on the whole Body; to wit, whether such a Juyce be nourishing of all the solid parts, or of some of them by themselves, as Authors variously think; or to what other office it is destinated.

Concerning these it first appears, that the Brain and Nerves, with the Juyce flowing out of them, contribute matter, or at least some influence to the work of nutrition; the which if it should chance to fail (a sign of which defect is, if the animal Faculty falters in part) the nourishment there is wont presently to be hindred or perverted. This is plainly seen in the Palsie, excited from an evident cause, without any previous Dyscrasie of the blood, where suddenly an Atrophy follows the privation of motion or sense, or of both together. Further, in the Scurvy, where the taint hath corrupted the nervous Juyce, when the sick begin to be afflicted with the Vertigo and swimming of the Head, and with wandring pains, Convulsions, and a frequent loosning of the Members, the flesh falls presently away, as in a Consumption, and without any fault of the Lungs, the sick wither away, as if distempered with a Phthisis. It is a vulgar observation, That from the immoderate use of *Venus*, also from an inveterate Gonorrhœa, from Strumous or running Ulcers, and other Impostumes, by which much of the nervous Juyce is wasted, a leanness or wasting of the whole Body is produced. Certainly, if I be not deceived, there are some Atrophies, yea, and sorts of breakings out, which seem to depend wholly upon the defect or the evil dispensation of the nervous Juyce, when the blood, as to its quantity and disposition, is not much in fault. Lastly, the consideration of some Diseases and Symptoms so plainly confirms the diffusion of the nervous Liquor and its great influence on all the parts, that there is even left no room for doubting.

Also no less doth the curing of some Diseases and the use of Remedies confirm the same. For from hence a reason is taken, wherefore Cephalick Plasters oftentimes yield such signal help in the *Phthisis*; not because they stay the *Catarrh* of the Serum falling down on the Lungs, (as the common people think) but because by corroborating the Brain they restore the disposition of the nervous Juyce, before vitiated. For this cause it is, that some diseases being stirred up by the fault of the nervous Liquor, of which sort among others are Cancrous and Strumous Ulcers, or such as come of the Kings-Evil, are hardest of all to be cured; because the morbid tincture of the Brain, and of the *Latex* watering it (whether it be innate or acquired) is not easily mended: yet sometimes when the root of the disease, lurking in the Brain or nervous stock, is taken away by the help of Nature it self, or by Chance, by the use of some remedy; presently the Symptoms of other parts, though neglected in the whole, vanish, not without the suspicion of a miracle. But how much the alteration of the Brain serves for

for the curing of some most grievous diseases, some instances taken from the Farriers Art will clearly shew.

For when many Medicines and Methods of Administrations are wont to be tryed in vain for the curing the stinking disease in Horses, commonly called the *Farcy* (which *Helmontius* asserts to be like the French Pox, and the Author of its Contagion) the most certain means of curing (which I have very often known to be applied with good success) consists in this; that some sharp Medicines, of which sort are Hearts-ease, Water-Pepper, Ranunculus or Crowfoot, and the like, which very much abound in volatile Salt, being bruised into a mass, and put into the Ears of the diseased Horse, and kept there for twenty four hours: it is scarce credible by what means all the Ulcers are presently dried up, and the disease healed, as it were by Inchantment, is quickly profligated in the whole. For since this Application is made far from the affected parts, without any alteration of the bowels or the blood, it should be so healed at a distance; certainly the cause of such an Energy must only be, that by this kind of Medicine the Dyscrasie or evil disposition of the Brain and nervous Juyce is taken away, and so the first root of the sickness being cut off, the shoots and fruits presently wither. It were worth our labour to try such kind of Experiments also in our Medicines. Yea it may be well suspected, that such a way ought to be ordered for the common Cure of the Kings-Evil. Among our Country-men, as delivered from our Ancestors, it is thought that the seventh Son, or he that is born the seventh one after another in a continued series, can cure this disease by stroking it only with his hand; and truly I have known many, whom no Medicines could help, to have been cured in a short time only by that remedy. Few doubt but that this disease is wont to be cured often by the Touch of our King. The reason of such an effect (if it be merely natural) ought to be assigned not to any other thing than that in the sick (especially those of ripe age) the Phantasie and strong Faith of the hoped for Cure induces that alteration, or rather strengthening to the Brain, whereby the morbid disposition radicated in it is profligated. But I shall return from whence I am digressed, to inquire what the nervous Juyce contributes to nutrition.

2. I say therefore secondly, although nutrition depends in some measure upon the influence of the nervous Juyce, yet it is highly improbable, that all the several parts of the whole Body should be nourished only by this provision. For besides that this were to impose upon the Government of the Soul it self, and its primary Organs, the cooking office of nutrition wholly unworthy the excellency and dignity of those parts; it seems also that the nervous Liquor should be altogether unfit for the administering to this Province: because when oftentimes immense expences are made of the aliment to be assimilated into the substance of the solid parts, especially by immoderate sweat, also by continual labour and exercise, which Country-men and Labourers daily use, it is not possible that such losses should be repaired only by the nourishment supplied, or sent through the small passages of the Nerves.

When I had long and seriously considered with my self concerning this thing, what I at length thought, I shall tell you freely, and without any covering, or making any reflection, or blaming the Opinions of others. It seems first, that the nourishing matter of the whole Body is distributed into all parts from the blood through the Arteries; yet it may lawfully be thought, that the conversion of this matter into nutriment, and the assimilation of it into the substance of the part to be nourished, is performed by the influence and help of the nervous Juyce, as it were of a certain spirituous Ferment. As to the first: we have already noted, that the sanguiferous Vessels do not only follow almost every where the Muscles and Bowels, but also the Head and its Appendix, yea the Membranes, Bones, and Nerves themselves, and affix to them all thick shoots, as so many little chanel, for the receiving the nourishment. Moreover, as there is a purple crassament or thick substance in the blood, whose substance stuffs and nourishes the Pores of the Parenchyma of the Muscles; so there is a whitish Gelly, by which the Membranes and the whiter parts seem to increase. Besides it may be observed, that the blood it self increasing, contains in it self fibres and small threads, such as are interwoven in the Muscles and nervous parts; and if the same stand long in any Vessel, it is presently coagulated into longish, white, and hard crusts or bits, whose substance is plainly fleshy; so that the blood produces flesh of it self, though the same be rude and unformed: wherefore the configuration and the apt disposition of the nourishing matter, supplied from it, depends on the coming and Energy of the nervous Juyce: but after what manner this is done, we shall endeavour now to shew.

After

After the web or stuff of all the parts is laid, it is required then that they be both drawn forth in due proportion, and grow in substance, and also that the little spaces which are left by reason of the Effluvia's perpetually falling off, may be continually filled with the nourishing substance cast in. In these two things the business of nutrition chiefly consists; for the performing of either of which the blood affords matter, and reaches it forth (as was said) in the circulating to the several parts of the concrete, and as it were stands at the doors of the part to be nourished: yet, that this matter may be rightly disposed, and its particles, to wit, the thick and thin, saline and sulphureous, and others of a several nature, separated one from another, may be employed with some choice to the destinated uses, there seems need of a certain directing faculty, and as it were plastick virtue, got somewhere else than from the blood it self. For indeed the blood being destitute of animal Spirits, is unfit for the performing these offices. Wherefore, for that it appears there doth lye hid in the nervous stock, a certain juyce, and the same being gifted with animal Spirit to be diffused to all parts, how can we suppose less but that this subtil and spirituous Liquor, every where meeting with the arterious, which is duller and thicker, actuates and inspires it, and as it were ordains it for the performing the designed work of nutrition? especially when it plainly appears, that by reason of the defect or depravation of this nervous Juyce, nutrition is always frustrated or perverted.

Therefore it may be lawful, in the difficult Controversie concerning the Matter and Method of Cure, to propose this our Hypothesis, though it be a Paradox and very abstruse; to wit, that the nervous Juyce (which we have said was like the male seed) is poured out with the nutritious humor copiously suggested from the Arteries, as it were the genitive or seed of another Sex, every where upon all the parts; and that this former, being indued with active Elements, imbues the more thick matter, as with a certain Ferment, and impregnates it with animal Spirit; and when it so makes it, with a mutual entring in or coming together, to be dissolved and to go into parts, its particles being extricated one from the other (the Spirit infused helping) they are put upon bodies of the same measure with themselves, and are assimilated into their substances. In the mean time, because the animal Spirits are poured out in great plenty with the nervous Juyce, those which are at leisure from the work of nutrition, or remain after that is finished, turn aside every where into the Fibres, as into proper dwelling-houses, and there being ready for the offices of sense and motion, stay; which offices indeed, that those Spirits the Inhabitants of the Fibres, may the better perform, they acquire from the blood watering the Muscles, certain auxiliary forces, wherefore they being endued with a certain elastick force, are apt to be highly rarified and as it were exploded.

But indeed we suppose, that as the nervous Liquor, being turgid with animal Spirit, causes the arterious humor to become nutritious; so in compensation of this the animal Spirits remaining of the work of nutrition, and every where disposed within the Fibres, receive from the arterious blood a mixture or certain Copula; by whose help and cooperation the same Spirits exert or put forth much more strongly their locomotive force. For it seems that little sulphureous bodies are added to the spirituous-saline particles from the watering blood; and so when the animal Spirits are furnished with this Copula, they being stirred up into motion, shake off the borrowed particles, which being struck with a certain force, like the explosion of Gun-powder, suddenly intumesc the Muscles, and so by contracting them very much, they cause a vehement motive endeavour. We shall have an occasion of discoursing more at large of this, when we treat of the Motion of the Muscles.

Yet in the mean time, we shall take notice, that the Muscles of the whole Body, as to their motion, have a certain Analogy with the motion of the Heart. For indeed the animal Spirits in the Heart, flowing within the fibres and nervous threads, (with which this part is much beset) receive plentifully sulphureous little bodies from the inflowing blood distending the sides of either bosom, which whilst the same Spirits, being filled to a fulness, shake off and as it were explode, a *Systole* of the whole Heart (its sides being carried with a certain force inwards) is brought in or caused, whereby the blood, from either side the bosom, is cast out as it were by the impulse of a Spring or Bolt. Truly, unless the Spirits inhabiting the Heart, should receive food and matter of explosion from the blood it self, their stock, supplied or sent by the passage of the few and small Nerves, would not suffice for the performing of the undisturbed continued motion. A sign of this is, that from a defect or depravation of the blood,

as well as of the animal Spirits, the motion also of the Heart is defective or diminished. And not much unlike in the Muscles, as in the Heart, is the business performed; the Spirits inhabiting their Fibres, receive a sulphureous Copula and apt for explosion, from the blood there more plentifully flowing than about the Membranes, with which being endued, as often as they receive from the Nerve as it were the fiery kindling or the match, the instinct of the motion to be performed, they being excited, and striking of their Copula, very much inflate or blow up the Muscle, and intumescit it for performing or compassing the motive endeavour. Nor is it much to purpose, or makes any great difference, that the motion of the Heart, stirred up by a perpetual instinct, is found always necessary; but the Muscles the most of them only occasionally and at the command of the Animal, do put forth their motive power; for the *Diaphragma* and some Muscles, dedicated to Respiration, are urged with a perpetual *Systole* and *Diastrale*, as well as the Heart it self.

From the aforesaid Hypothesis concerning the offices and uses of the nervous and arterious Juyce, Arguments that otherwise determine the work of Nutrition, may be easily answered. For that the blood is said rather to prey upon the solid parts than to replenish them, that ought to be attributed to the Disease and Dyscrasie of it, and not to it simply: because sometimes the blood is accused, for that it too much stuffs the solid parts; to wit, forasmuch as its mass being waterish and weak, it lays aside the alible Juyce (which not being truly cook'd, is still crude and vicious) with very great plenty about the habit of the Body, and so induces an *Anasarca*. In the mean time it ought to be granted, That as it is the blood that is evil which heaps up too much vicious nutriment; so it is the same, which being well and right, doth laudably perform the office of Nutrition.

But that it is argued, That the nervous is rather the nourishing Juyce, because by reason of its defect, depravation or too prodigal expence, the acts of nutrition are wont to be hindred or perverted; it is easie to reply to this, That the impediments of the nervous Juyce, being made vicious, respect the form of nourishment, and not the matter of it: to wit, it sometimes happens, that the blood dispenses the alible matter in due plenty and disposition; which notwithstanding, by the fault of the nervous Juyce, is not rightly assimilated. When an impotency of motion comes upon a too great distension of the Muscle or Tendon with pain, shortly nutrition being hindred, a Jelly grows about the distempered part: which notwithstanding drops not out of the Nerve (as is commonly said) but the glutinous humor being poured out of the Arteries for aliment, for that it cannot be received by the hurt part, is gathered together there: nor is it to be thought, that Tumors, or Strumous Ulcers or the running Sores of the Evil do contain or pour out only a nervous humor, since the matter of either is for the most part bloody, which by reason of the evil Ferment of the nervous Juyce, puts on a strange form, and that diversly degenerated.

This supposition of the twofold Humor, for the matter and form of nourishment, is taken to be of egregious use for the solving of the most difficult Phænomena, which are met with about the Distempers of the Brain and nervous Juyce: yea, that Pathology, seriously considered, seems to infer as a certain necessary consequence, that a twofold Juyce is necessary for the work of Nutrition; as some other time perhaps we may shew. In the mean time, leaving this Speculation, we shall proceed to the remaining Task of our *Anatomy*, to wit, the *Neurologie* or of the Nerves in particular.

THE Description and Use OF THE NERVES.

C H A P. XXI.

*The first four Pair of Nerves arising within
the Skull are described.*

THE division or distinction of the Nerves, by reason of their various respects, is wont to be manifold: to wit, as they are either soft or hard, singular or numerous in their beginnings; or that they serve either to the faculty of Sense, or Motion, or to both together. But they are commonly distinguished, That some Nerves arising within the Skull, proceed from the oblong Marrow; and others going out of the joynts of the *Vertebrae*, are derived from the spinal Marrow. But besides these, another manner of differencing them seems best to us; to wit, That some Nerves, as it were Clients and Servants of the Brain, perform only spontaneous Acts, and others, Ministers and Servants of the Cerebel, are employed only about the exercises of the involuntary Function. There will be no need to assign different Essences or Constitutions of Nerves according to these several differences: but rather that there be instituted a particular Cense or Muster of them, and following the order of Nature, that we especially unfold every one of them in the series in which they are disposed in the animal Body.

Among the Nerves arising from the Skull, the smelling Nerves, or those which are commonly called the Mammillary Processes, lead the way; for that they have their rise before all the rest, and are stretched out forward beyond the Brain it self. These Nerves go out of the shanks of the oblong Marrow within the chamfered bodies and chambers of the Optick Nerves; and being endued with a manifest cavity, open into the first Ventricle of the Brain on either side behind the same chamfered bodies; so that the humidity flowing between the folding of the Brain, is carried through these chanelles into the mammillary Processes; whether they go farther forward, shall be anon inquired into: Because these Nerves being broad and large, arising near the chamfered bodies, and from thence stretched forward under the Basis of the Brain, their bulk is increased by degrees till they go into the round Processes like Paps, by which either bosom of the Cribrous or Sieve-like Bone is besmeared. Within the Socket of this Bone these Nerves, as yet soft and tender, obtain Coats of the *Dura Mater*; with which being divided into many fibres and filaments, and passing through the holes of the Sieve-like Bone, they go out of the Skull: from whence being dilated or carried forward into the caverns of the Nostrils, and distributed on every side, they are inserted into the Membrane bespreading those Labyrinths.

If we inquire into the nature and use of these parts, without doubt the mammillary

Processes and their medullar roots, with the fibres and small threads hanging to the same, are truly Nerves, and serve properly for the very Organ of the Smell. Seeing these conduce to the sense only without any local motion, therefore (even as the other hearing Nerve) whilst they are within the Skull, they are plainly medullar and soft; whereby the animal Spirits more easily moved within the more tender substance of the Nerves, might convey more readily and accurately to the common Sensory the Ideas or forms of the sensible Species: But because the effluvia's or odorous breaths to be received by the naked Organ, carry oftentimes with them sharp and pricking Particles hurtful to the Brain and Nerves; therefore in the first course these Nerves being about to go out of the Skull, borrow Coats from the *Dura Mater*, which serve for Armour. Further, as these breaths (lest they should strike more sharply by rushing impetuously on the Sensory) being admitted only by little and little, and by small bands, ought to be brought through divers narrow turnings and windings of the Nostrils; therefore that these Nerves may the better receive the effluvia's flowing within the several dens, they are so divided into very many fibres and small threads or filaments, that there may be no passage of the Nostrils to which at least some of them are not destinated. And after this manner, although the exhalations, as it were torn into little Clouds, are received by the nervous filaments, and so care is sufficiently taken, that they being more thickly elevated, may not overwhelm or obscure the Sensory; yet lest any thing sharp and troublesom should be carried with them to the Brain, the cribrous bone is set before the doors as an obstacle, through whose little holes being strained, they may put off all sharpness. And lastly, they being carried through the softer Nerve, as it were another Medium, and so broken again, they at length being soft and gentle enough, are staid at the first Sensory.

But that these Nerves are noted through the whole with an open hollowness within the Skull, the reason seems to be, that the watry humor stilling out of the foldings of the Brain, and being derived into those chanel, might beat back and temper the impressions of the odours, when too sharp and fiery: for as the humors included in the Eye, variously refract the visible Species, whereby it passing at last through the Optick Nerve without any force, slides pleasantly to the common Sensory; so it is not improbable, that the water contained within these passages of the Nerves, does in like manner sweeten the species of the odours, and prepare them in some measure for the Sensory. Wherefore it is observed, that Cattle and Beasts which are fed with herbage, have the mammillary Processes exceeding large and always full of water; to wit, lest the odours of the herbs continually attracted by them (unless their force should be blunted after the aforesaid manner) might hurt or overthrow their more weak brain. Besides, it is very likely that this watry juyce falling down from the infolding of the Brain, doth not only flow into the open chanel of the Nerves and the mammillary Processes, but also doth pass through by the passage of the fibres and filaments the holes of the Sieve-like Bone, and doth wet and continually moisten the cavities of the Nostrils, apt to be dried or torried too much by the Air thither attracted, and by the breath continually blown out. For it clearly appears, as we have elsewhere shewn, that the serous humors creep through the blind passages of the Nerves and Fibres, and by them wander from place to place. Yea it may be thought, that not only water, sufficient for the watering the Nostrils, doth by this way sweat through; but also whensoever the serous heap is gathered together in the Ventricles of the Brain, its superfluities or the excrementitious humor doth very often pass through the cribrous Bone by the passage of the Fibres, and is sent out. But we have in another place discoursed more largely of this.

The smelling Nerves, which have within the Skull their mammillary Processes depending on them, are much greater in an Ox, Goat, and in Cattle, and such like beasts that live on herbage, than in flesh-eating Animals; to wit, because in those there seems to be more need of the sense of smelling to be more exquisite for the knowing the virtues of the manifold herbs. Also these Nerves are larger in all Brutes than in Man: the reason of which is, because they discern things only by the sense, and especially their food by the smell; but Man learns many things by education or nurture and discourse, and is rather led by the taste and sight, than by the smell in chusing his aliments. These Nerves in Birds, as also in Fishes, are conspicuous enough; for either of these, even as four-footed beasts, seek out and chuse their food by the help or knowledge of the smell.

As to the Fibres and Filaments or little strings stretching out from the more soft Nerves

Nerves through the holes of the Sieve-like Bone into the caverns of the Nose, these are found in all Creatures who have the mammillary Processes: so that it is not to be doubted, but that these Processes, with this Appendix and its medullary origine, is the Organ of the Smell. And what more confirms this thing, these filaments or little strings are far more, and more remarkable in hunting Hounds than in any other Animal whatsoever. But besides these Nervulets drawn through the holes of the Sieve-like Bone into the Nostrils, two branches also are sent hither from the fifth pair, and distributed into both the Nostrils. The reason of this seems to be, because though the Nerves but now described, or of the first Conjugation, are properly smelling Nerves; and effect by themselves the sense of Smelling; yet these are assisted or joyned with other Nerves, also by those sent from the fifth pair, because the Organ of the Smell ought to have a consent with all other parts, which those subsidiary Nerves, by reason of the manifold branching out of the fifth pair, are wont to perform. It chiefly appears, that there is a certain nearness or strict affinity between the taste and the smell: and the cause of this consists, in that out of the same Trunk of the fifth pair certain Nerves are sent to the Palate, and others to the Nostrils. Concerning the reason of that wonderful consent which the Nostrils have with the *Præcordia* in sneezing, also wherefore that light titillation stirs up a Cough, shall be spoken of hereafter, when we come to unfold the fifth pair and the intercostal Nerves. But in the mean time we shall take notice, that although many Nerves belong to the Organ of Smelling, yet that sense is properly performed by the Fibres interwoven in the inward Coat of the Nostrils: for those Fibres being struck by the sensible object, move and contract themselves variously according to the Idea of the impression; which Affection of them being carried by the passage of the Nerves to the Head, so far as it is there staid by the common Sensory, causes the perception of the sense. Those sensible Fibres are diversly figured in several Animals; which is the reason, why odorous things do not alike affect all Animals. For what things by a mans nostrils, as endued with too sharp and pricking Effluvia's, are esteemed highly naught and stinking, as especially are dung and putrid flesh; the same are to Dogs, whose Organ of Smelling is made or consists of more robust or strong Fibres, and proportionate to those Effluvia's, as very grateful and chosen for food.

The second Conjugation are the Optick or seeing Nerves: concerning which we have shewn already, in the Anatomy of the Brain, after what manner they arise from behind the chamfered bodies out of the second section of the medullar shanks (which *Galen* calls the *Chamber* of the Optick Nerve) and descending from thence with a certain compass are united, and being again separated and carried into the Ball of the Eyes, constitute with diffused Fibres the hard Coat. Moreover, in those Observations we did but now take notice, that the Trunk of this Nerve growing a little hard without the Skull, was as it were a little bundle of very many Fibres or small strings growing together into one, and of produced Parallels, as it should seem for that end, that the animal Spirits, flowing in the whole Nerve, might be moved in so many lines or direct rays; to wit, whereby they may carry the visible Species, sufficiently refracted in the Eye, thence to the common Sensory by a direct beam, and not intorted or rolled about.

As often as in the distempers of the Eyes blackish pricks or concatenated pieces of any thing seem to be rolled before the Eyes, it is likely that this apparition is so made, because certain filaments or small strings of the Optick Nerve are shut up, which when the light cannot pass through rightly, as through the rest, so many as it were shadowy spaces appear in the middle of the clearness. These Nerves, because they only serve for the sense, are therefore more soft within the Skull: but because there may be need perhaps, that the Trunk of this Nerve ought to be sometimes dilated or spread abroad, sometimes bound close together or contracted according to the divers appearance and incourse of the objects; therefore very many Fibres, being sent out from the motory or moving Nerves of the Eyes, do every where compass and bind it about, and entring with it into the Ball of the Eye, are inserted partly near the root of the Optick Nerve, and partly penetrate more deeply the Sclerotick or hard Coat it self.

Further, the Optick Nerves are not only bound or environed with nervous Fibres sent from the third pair, but (as we have shewn above) with sanguiferous Vessels in their whole process. The office of which certainly is, both that there might be every where about the greater Trunk of this Nerve as it were a continual heat or sufficient fire.

fire-place ; also perhaps, that the food of the bloody humor might be supplied to the Spirits, living there within the trunks of the nerves, far from the fountain, as is wont to be in other places.

Concerning the Fabrick of the Eye it self, and manner of seeing, also concerning the whole dioptrick provision, here seems a fit opportunity of discoursing : but this were to digress too far from our purpose, to wit, the mere or naked Doctrine of the Nerves ; and I may the better pass by this addition, because this Province hath been sufficiently and accurately adorned by others. In the mean time we shall take notice, that as in the smelling, so also in seeing, the sense is performed, not so much by the help of the nerve, as of the fibres, which are interwoven with the organ : to wit, the little fibres in the Membranes of the Eyes, and especially those inserted into the Sclerotick Coat, and disposed after the manner of a net, do receive the impression of the visible Species, and by representing the image of the thing, so as it is offered without, causes sight. But it is the office of the nerve it self to transmit inwardly, as it were by the passage of the Optick Pipe, that image or sensible Species, and to carry it to the common Sensory.

The third Conjugation of Nerves are the moving nerves of the Eyes, which arise in the Basis of the medullar Stem behind the Tunnel ; from whence going forwards nigh the pair of seeing nerves, and going out of the Skull with the other nerves destinated to the Eye, they are carried towards the Globe of the Eye ; where, being presently divided into many branches, they provide it with moving Muscles ; but with various difference in divers living Creatures. For in an Ox, who hath got a larger eye, the moving nerve of the eye imparts a branch to every one of the six common Muscles ; and besides, from the nerves of the fourth, fifth, and sixth pair certain branches are distributed to some of the same Muscles : so that, as often as any Animal intends or applies the sense for the perceiving of this or that object, these nerves turn about the Eye, and compose it at their pleasure for the spontaneous beholding of the same. Besides we take notice, that the Eyes do get a diverse kind of involuntary motion ; because in Fear, Shame, Anger, Sadness, yea and in all Affections of the Head and Heart, whether we will or no, the Eyes are respectively figured. Wherefore 'tis highly probable, that these kind of pathetick motions of the Eyes, whereof the living Creature is scarce knowing, are performed by the help of the other nerves, to wit, of those coming from the fourth, fifth, and sixth pair : and that more manifestly appears, because the same nerves which lend their branches to the Eye, take their origines from the Cerebel, the office of which we have often shewn to be, to dispense the Spirits for the exercise of the involuntary Function.

But concerning these Nerves of the third pair, which are properly called the Moving nerves of the Eyes, we observe, that in Man, a Dog, and in some other living Creatures they are found to be somewhat otherwise than in an Ox : for either nerve in these, as in the rest, is carried out of the Skull, divided into four branches, three of which are carried from thence into three straight distinct Muscles, to wit, one lifting up, the other bringing together, the third pressing close the Eye ; the other branch of it goes forwards further with a single trunk, and is implanted in the middle of the Muscle going about the Eye, turning obliquely to the inward corner downwards. From these it appears, that these Muscles, to which this nerve belongs in all, are sufficient almost of themselves to perform most spontaneous motions of the Eye : but where the aforesaid nerve is divided into four shoots, it constitutes a small and round infolding, out of which many small shoots creep through, and variously compass about the trunk of the Optick nerve ; for what use it is so made, we have already intimated.

The fourth Conjugation of Nerves (which we call rightly the Fourth by order and succession, although it is accounted the eighth and last by *Fallopins*) hath a diverse origine from all the rest. For whereas most of the others proceed from the foot or sides of the oblong Marrow, this hath its root in the top of it behind the round Protuberances, called *Nates* and *Testes* : From whence, bending more forward nigh the sides of the oblong Marrow, it is presently hid under the *Dura Mater* ; under which going along for some space, and passing through the Skull at the same hole with the rest destinated to the Eye, it is bestowed with a single trunk, not communicating with any of the other nerves, wholly on the Muscle called the *Trochlear* Muscle. Above we called these nerves the *Pathetick* nerves of the Eyes : for although some besides may deserve this name, (as shall be shewn by and by) yet 'tis most likely, that the proper

proper office of these is to move the Eyes pathetically, according to the force of the Passions and instinct of Nature, delivered and remanded from the Brain to the Cerebel, and so on the contrary, from this to that through the *Nates* and *Testes*, and their medullar Processes. For, as we have shewn, that by the diverse impulse and waving of the animal Spirits dwelling in this by-path, there are instituted certain mutual commerces between the Brain and the *Præcordia*, (the Cerebel mediating between either) it will be of necessity, that these nerves, rooted in the middle way, should be struck by every tending downwards or remove of the Spirits, going this way or that way, and so the motions of the Eyes to follow the affections of those parts. All perfect Animals are furnished with these nerves; and in truth, as none of them but are obnoxious to Anger, Love, Hatred, and other Affections, so every little Creature shew these by the mere aspect and by the gesture it self of the Eyes. We see sometimes the greater Pike gaping for his prey first of all to roll about his eyes, and to look four; then with a swift shooting out of his body to invade the lesser fry of fish.

C H A P. X X I I.

The fifth, sixth, and seventh Pair of Nerves are unfolded.

OF the aforesaid four Pair of Nerves, the two former seem chiefly to serve for the Sense only, but the two latter for Motion; and every single nerve of them destinated to a peculiar Province: but this which follows next, to wit, the fifth Conjugation of Nerves serves for the exercise of either Faculty, to wit, both of Sense and Motion; nor is its Province so strictly bounded, that it should belong only to one member, for it is distributed to the Eyes, Nose, and Palate, and the rest of the parts of the Face; and besides, helps in its part in some sort the offices and actions of the *Præcordia* and almost of all the *Viscera*.

This pair (which by the Ancients was accounted the third, by us the fifth pair, and that by right of order or position) below the former nerves, proceeds with a broad and large trunk from the sides of the annular Protuberance or Process sent out from the Cerebel. It consists of very many Fibres gathered together, some of which are soft, others hard; so that the great trunk of it near its beginning, is nothing else than a little bundle of very many nerves, some of which are bestowed on these parts, and others on other parts, and in some they perform the offices of motion, in others of sense. But that so many nerves being destinated to so many several members, and remote one from another, yet arising together, are collected as it were into one bundle, the reason is, that in all the parts to which those nerves belong, a certain Sympathy and consent of actions might be conserved: to wit, the communion of those nerves is the cause why the sight and smell move spittle and please the Palate; nor by any other means are the *Præcordia* affected, according to the various conceptions of the Brain, and transmit their affections to the several parts of the Face; from whence the aspect or countenance of the whole Animal is pathetically figured, as shall be shewed more particularly below.

In the meantime, let us deliver a short Hypotype or figure of this Nerve; its trunk going out of the sides of the greater Ring, sometimes near its beginning, but oftner the *Dura Mater* being first perforated or passed through, is divided into two noted branches. The first of these tending straight downward, going out of the Skull at a proper hole, in its descent towards the lower Jaw, (to whose parts it is chiefly destinated) is divided into more branches, with which it furnishes the Temple-muscle, also the Muscles of the Face and Cheeks. Moreover from them shoots and branches are distributed into the Lips, Gums, roots of the Teeth, Jaws, Throat, the farther end of the Palate, yea and the Tongue; for this reason chiefly, that the nerves going out of the lower branch of the fifth pair, might effect, besides sense, the divers offices of Taste and Touch or Feeling, and motions of a various kind in the aforesaid members and parts; most of which, as the chewing of the aliment, also those which have respect to configuration or framing of the mouth and face in laughing or weeping (as we have already noted) are performed unknown to the Brain, that is involuntarily, and by the help of the Cerebel only, from which these Nerves are derived.

The

The other superior, and also the greater branch of the fifth pair under the *Dura Mater* nigh the side of the Turkey Chair goes straight forward for a little space, and is enlarged into some shoots over against the pituitary Glandula to the trunk of the Carotick Artery or the wonderful Net, (where it is present) then it is inoculated into the nerve of the sixth pair, and from thence sends back sometimes one, sometimes two shoots; which being united with another shoot, turned back from the nerve of the sixth pair, constitute the root or first trunk of the intercostal Nerve. Concerning this intercostal nerve, which is made of the lower ramification or branching out of the nerves of the fifth and sixth pair, it shall be spoken of particularly hereafter.

Presently after the branches or shoots reflected or bent back for the root of the intercostal nerve, that greater nerve of the fifth pair is divided into two noted branches. The lesser and uppermost of these tending towards the globe of the Eye, and becoming again twofold, sends forth two branches from it self; one of which turning towards the inward side of the Bone, containing the ball or angle of the Eye, is divided into two shoots. The other of these having passed through the Bone nigh the mammillary Processes, is carried into the nostrils: the office of this nerve is to keep a Sympathy and consent of action between the nostrils and some other parts: but the other branch of this division is bestowed on the Muscle by which Brutes wink.

The second Ophthalmick branch of the fifth pair is divided into four or five shoots, all which going forward above the Muscles of the Eye, and in some part passing through its Glandula's, are almost all lost in the Eye-brows, unless that in the passage they send down two small shoots which enter the *Sclerotick* Coat a little below the Tendons of the Muscles, and reach to the *Uvea*, or the fourth thin Membrane that cloaths the Optick nerve; yea and also send in the passage small shoots to the Glandula's of the Eye. It seems that these nerves of the fifth pair, being distributed into the Glandula's of the Eyes and Eye-brows, serve chiefly to the involuntary and pathetick actions of those parts; the chief of which are, the languishing and mournful aspect of the Eyes in weeping, and the unwilling pouring out of tears. For as the lower branching of the fifth pair, to wit, the intercostal nerve, provideth in man for the *Præcordia*, it easily happens, that from the sad affection of these, the Cardiack branches of this nerve being forced and wrinkled into Convulsions, the aforesaid Ophthalmick branches also so correspond, and by wrinkling the Eye-brows, and by compressing the Glandula's, produce those kind of looks of the Eyes, and marks of sorrow and grief. Further it is observed, that from the Ophthalmick branch of the fifth pair a certain shoot is sent back higher nigh the heads of the Muscles; which when it has passed through at a proper hole, the Bone containing the ball of the Eye, is carried straight into the caverns of the Nostrils. Hence, as I think, a reason may be given, wherefore passing out of a dark place into the light, at the first beholding of the Sun, presently whether we will or no we shall sneez; to wit, the eyes being too strongly struck by the object, and being suddenly and disorderly moved, that they might turn themselves aside, the same affection is immediately communicated through the aforesaid Nerve to the Membrane covering the hollow caverns of the Nostrils, which being thence contracted and wrinkled, (as it is wont by some sharp thing pulling it) provokes sneezing.

The second or greater branch of the second division of the Nerve of the fifth pair being carried nigh the ball of the Eye, is again divided into two branches. The lower of these being bent downwards, cleaving into many shoots, is bestowed on the Palate and upper region of the Jaws: The other and higher branch of this second division stretching beyond the ball of the Eye, passes through, together with the Vein and Artery, a proper hole made in the bone of the upper Jaw; which Vessels this Nerve climbs and variously compasses about with many shoots sent forth; then arising out of the bone, it imparts little branches to the Muscles of the Cheeks, Lips, Nose, and to the roots of the upper Teeth. Therefore forasmuch as this Nerve embraces and binds about the sanguiferous Vessels destined to the Cheeks and the other parts of the Face; from hence a reason may be given, why the face is covered with blushing by shame: for the animal Spirits being disturbed by the imagination of an unseemly thing, by and by endeavouring as it were to hide the face, their irregularities enter this Nerve, so that the shoots of the same Nerve embracing the blood-carrying Vessels, by compressing and pulling the same, cause the blood to be more forced into the Cheeks and Face, and the Veins being bound hard to be there for some time staid and detained. But forasmuch as many shoots and fibres of the same maxillar Nerve, derived from

from the fifth pair, interweave themselves with the flesh and skin of the Lips, hence the reason is plain, why these parts are so very sensible, and besides, why the mutual kisses of Lovers, impressed on the Lips, so easily irritate love and lust by affecting both the *Præcordia* and Genitals; to wit, because the lower branching of the same fifth pair actuates these parts constituted in the middle and lower Belly, and draws them into the like affection with the Lips. The same reason holds of Love presently admitted by the eyes, that as the Poet says,

Mars videt hanc, visamq; cupit.
As soon as Mars saw her, he desir'd her.

We have but now intimated, that many shoots of this Nerve were destined for the business of chewing; and therefore, because the aliments to be taken ought to undergo not only the examination of the taste, but also of the smell and sight, from the same Nerve, whose branches being sent to the Palate and Jaws, perform the business of chewing, other shoots, as it were fore-runners, are carried to the Nostrils and Eyes, to wit, that these Organs of the other Senses might be furnished with some helps of probation also, for the better knowing or distinguishing the objects of taste. Certainly from the nearness of kindred and manifold affinity of this Nerve, being also much diffused in the Head, the mutual dependencies and confederations of very many of its parts, proceed. But how this Nerve in other Provinces, to wit, in the *Thorax* and lower belly, and there about the motions and sensations of the *Præcordia* and *Viscera*, doth cause various Sympathies of them among themselves and with other parts, shall afterwards be more largely shewn, when we shall speak particularly of the intercostal Nerve, which is rooted in this nerve of the fifth pair; where, from the manifold communication of this nerve, may be easily drawn the reasons of sneezing, yawning, laughing, crying, and of other actions merely natural. In the mean time, the superior branching of the nerve of the fifth pair shews it self after this manner in the Head, and almost after the same manner is divaricated in most living Creatures; except however, that in some, presently after its rise, it is divided into three great branches; one of which is destined to the lower Jaw, the other to the Eye and Nose, and the third to the Cheek.

The Nerve of the sixth Conjugation follows, which arising out of the lowest foot of the annular Protuberance, and being hid under the *Dura Mater*, presently goes out of the Skull at the same hole with the nerves of the third and fourth pair, and is carried with a single trunk into the ball of the Eye; but so, that near the side of the Turkey Chair it is inoculated with the second branch, or the greater of the fifth pair; from whence it turns back, sometimes one little branch, sometimes two; which being united with the branches of the fifth pair running back, constitute the beginning of the intercostal nerve. Then this nerve going forwards, is divided into two branches near the ball of the Eye; one of which is inserted into the Muscle drawing back the Eye planted in its outward angle; and the other being torn into various fibres, is bestowed on the seventh Muscle proper to Brutes; so that this nerve also seems to serve to those motions of the Eye that are almost only pathetick, or excited by natural Instinct. For, as to the use of the former shoot, it plainly appears, that it is innate to every Animal in a sudden fear to draw the eyes backward, and to look for what is to be feared on either side and behind: then as to its other shoot, whereby Brutes wink or twinkle the eye, it is obvious that this same motion is sudden and extemporary, without any previous intention, whereby the eye endeavours to shun the injuries of outward things that occur.

The seventh Conjugation of Nerves, accounted for the fifth by the Ancients, is employed about the sense of hearing. Of this pair commonly are noted two Processes, the one soft; the other hard; which indeed seem to be two distinct nerves, for that although they have their beginnings nigh one another, yet are somewhat distinct, and are carried to divers Organs; in the mean time, either agreeing in a certain common respect of use or action. For whilst one nerve performs the act of hearing, the other supplies some requisites whereby that act may be the better performed: wherefore we shall not much strive against the common description of this pair, by which it is taken for one. The process of this pair, or the auditory nerve properly, which is called the soft Branch, seems to arise in man out of the lower side of the ringy Protuberance, and in beasts out of the midst of the lesser Ring. In some Dissections I plainly found, that this softer nerve, having its beginning lower, seemed

to ascend a little before it went out of the medullar stock; and the other more hard nerve seeming to arise higher (*viz.* out of the medullar whitish line leading about the bottom of the fourth Ventricle) did descend a little, and arose near the meeting with the other. This softer nerve is carried into the passage of the stony Bone, where entering into the den destinated for the receiving the sound, which is on this side the Snail-like winding and the Drum, it so infolds it self into the most thin Membrane wherewith that den is covered, that as often as the Air implanted in that cavern is moved by the stroke of the external Air made upon the Drum, this impression striking this Membrane, and stirring up as it were an undulation of the animal Spirits, is forthwith carried towards the common Sensory by the passage of the nerve there implanted. There will be a more opportune place of discoursing, after what manner, and by what sort of Organs Hearing is performed, when we shall speak of the Senses.

The other Nerve of this pair, or the more hard process, which conduces rather to motion than sense, passing through the stony Bone at an hole proper to it self, arises near the auditory passage, where it presently receives into its trunk a branch from the wandring pair brought thither; then immediately after that joyning together or coalition, it is divided into two branches: The first of these tending downwards, is bestowed upon the Muscles of the Tongue and the Bone *Hyoides*; the other going about the auditory passage, and bending more upwards, is divided into three shoots; the first of which, answering to the nerve of the former division, bestows some shoots on the Muscles of the Lips, Mouth, Face, and Nostrils, and so actuates some exterior Organs for the forming the voice, as the former doth some interior Organs. The second shoot of this division distributes its shoots into the Muscles of the Eyebrows and Forehead; and the third into the Muscles of the Ear it self. The offices and uses of all these have been already shewn, the summ of which is, that as often as the sound is admitted in, especially if it be any ways unusual, new, or to be wondered at, presently by a certain natural instinct the Ears and Eyes erect and open themselves: to wit, for that end shoots from this nerve are inserted into the Muscles of the Eye-lids and Ears, that by the passage of these, the Spirits inhabiting either Region, might be called out as it were to watch. For a like reason shoots from the same hard process of this nerve are distributed both into the Muscles of the Tongue and of the Bone *Hyoides*; as also into those of the Lips and the outward parts of the Mouth, that by their passage, the sound being transmitted further to these Organs of the voice, it being equal or like the same, might officiously answer it as were an *Echo*. That the descriptions of the aforesaid nerves might be better understood, I have thought good here to represent in the following Figure the branchings of the fifth and sixth pair. The seventh pair is fitly delineated in the ninth Figure.

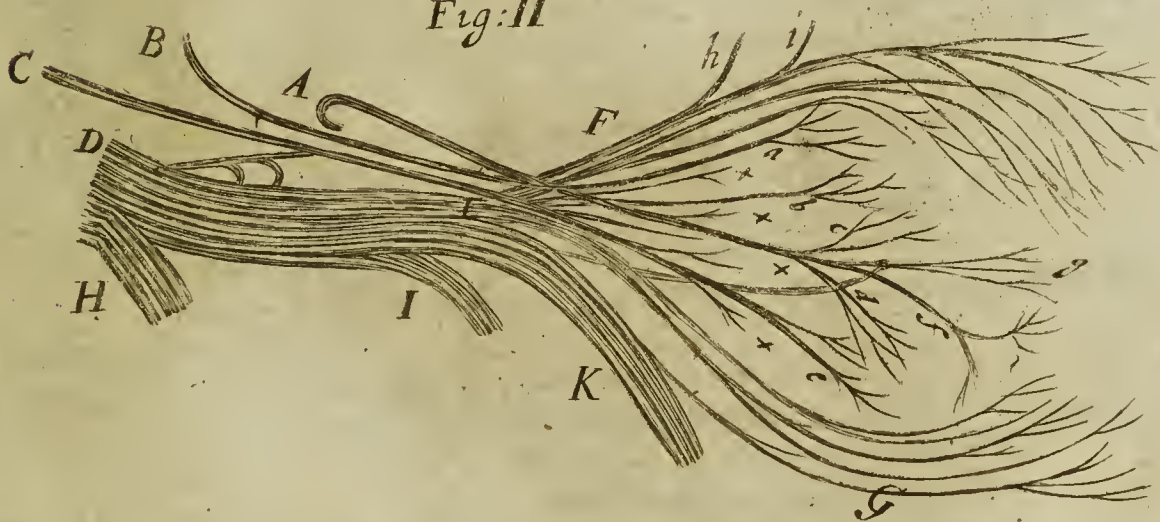
This Figure shews the Branchings of the fifth and sixth pair of Nerves.

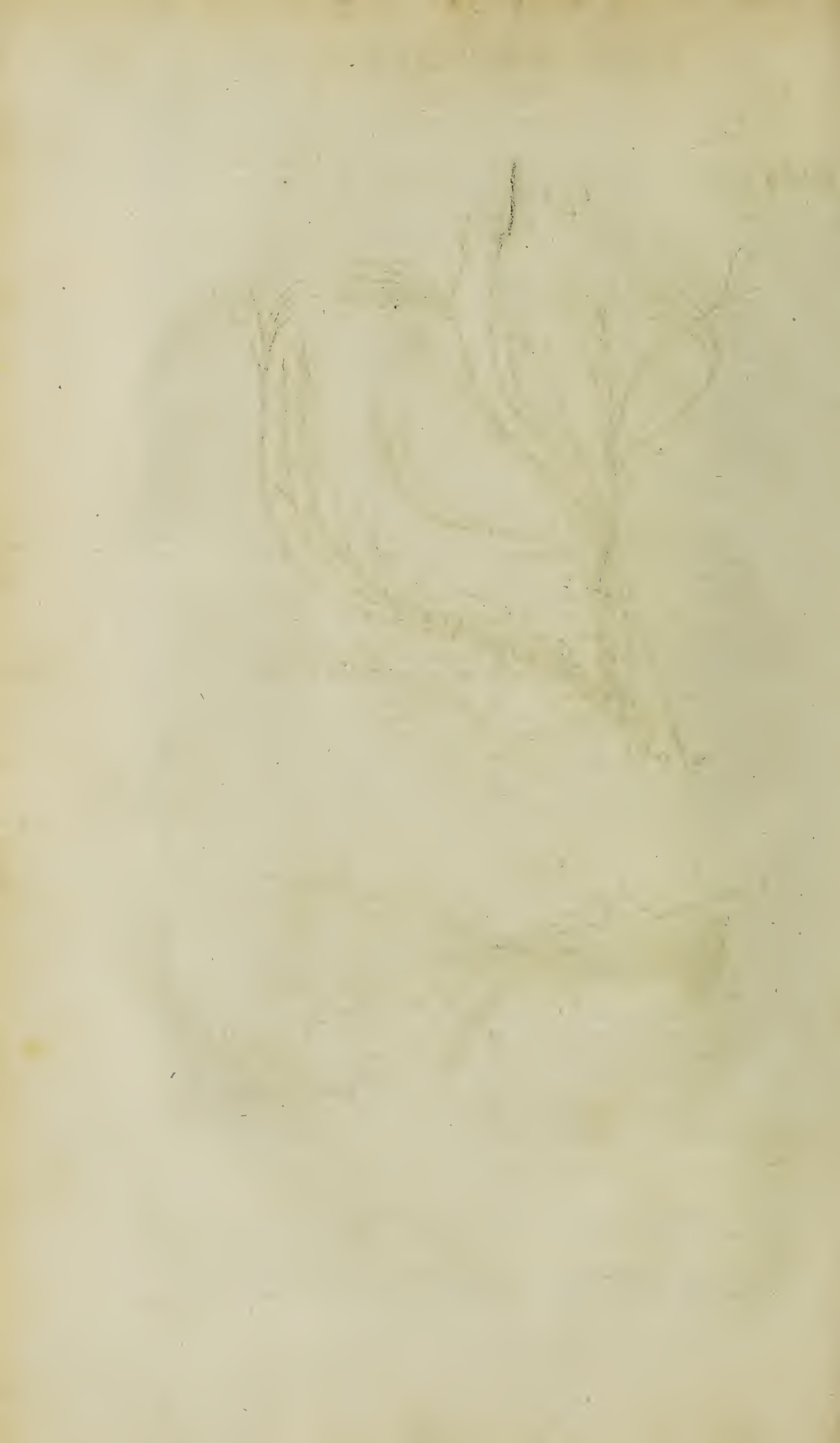
- A. The Nerve of the sixth pair (which we place first, because it is outmost in the Scheme) from whose trunk two shoots a. a. are carried into the two Muscles of the Eye.
- A. A shoot from the Nerve of the sixth pair bent back for the root of the intercostal Nerve.
- B. The trunk of the fifth pair being presently divided into two great branches.
- bb. Two shoots from this branch bent back for the root of the intercostal Nerve.
- C. The division of the upper part of the trunk into four lesser branches, the uppermost of which c. being the Ophthalmick or belonging to the Eye, and entering the orb of the Eye, sends forth four shoots.
- c. The first being carried nigh to the ball of the Eye, is bent back into the Nostrils.
- d. The second passing by the outward orb of the Eye, is carried into the Muscles of the Forehead.
- ee. The third and fourth are distributed into the Eye-lids and interior Glandula's of the Eye.
- D. The second branch of the second division is also Ophthalmick, which entering the ball of the Eye, and carried towards the outward corner of the Eye, is distributed into the Eye-lids and outward Kernels.
- E. The third branch of the second division, or the maxillar, which passing by the orb of the Eye, enters an hole proper to the bone of the Jaw, in which passage it sends forth

Fig: I.



Fig: II





- forth a shoot e. through another hole into the chewing Muscle, then arising up, it is carried out at the hole.
- f. A shoot into the Muscles of the Nose.
- ggg. It sends forth many shoots into the upper Lip.
- F. The lower branch or the fourth of the second division, which descending right towards the hollowneſs of the Mouth, is divided into two branches.
- h. The first is distributed into the Gums.
- i. The second is bestowed with many shoots upon the Palate.
- G. The second branch of the first division of the fifth pair, which tending straight downwards towards the lower Jaw, sends forth in its passage many shoots.
- k. A shoot of it into the Parotid Glandula's, or those near the Jaws.
- l. A shoot to the inward Mandible.
- m. A shoot which compassing about the proceſs of the lower Jaw, is carried to the outward part of the exterior Masticator.
- n. Another shoot tending opposite to the former, having compassed the ſame proceſs, is distributed into the inward part of the ſame Masticator.
- H. The trunk of the ſame greater branch carried further, is cleft into many shoots, of which
- o. Tends into the root of the Tongue.
- pp. Is carried with many shoots into the ſubſtance of the whole Tongue.
- q. Into the parts under the Tongue.
- r. Passing through the bone of the Jaw, is divided into many shoots which are diſperſed, partly into the lower Lips s.s. and partly into the Chin t.t.t.

The Second Figure ſhews all the Nerves, which being carried from the Nerves of the third, fourth, fifth, and ſixth Pair, are beſtowed upon the Muscles and other parts of the Eye.

- A. The Nerve of the third pair carried to the three ſtraight Muscles, and into the outward oblique one.
- B. The Nerve of the fifth pair, or the pathetick Nerve, goes whole into the trochlear Muscle.
- C. The Nerve of the ſixth pair into the drawing back Muscle, and the ſeventh proper to Beaſts.
- D. The Nerve of the fifth pair whose Ophthalmick branch E. is divided into two branches.
- F. The upper branch, being preſently torn into many shoots, tends directly towards the inner corner, where it is beſtowed on the Glandula's and Eye-lids.
- G. The lower Ophthalmick branch, which being divided into shoots, reſpects after a like manner the Glandula's and Eye-lids towards the outward corner of the Eye.
- a. The Nerve of the fourth pair for the trochlear Muscle.
- b. A branch of the Nerve of the third pair for the Muscle lifting up the Eye-lids.
- c. A branch of the ſame pair for the Muscle ſhutting the Eye-lids.
- d. A branch of the ſame Nerve for the Muscle preſſing cloſe the Eye-lid.
- f. A branch of the ſame for the outward oblique Muscle.
- g. Leſſer Nerves out of the infolding of the third pair, tending through the Sclerotick Coat into the Uvea.
- e. The Nerve of the ſixth pair for the drawing-back Muscle.
- *** Fibres or leſſer branches from the fifth and ſixth pair for the ſeventh Muscle, proper to Brutes.
- h. A Nerve coming from the upper Ophthalmick branch into the Noſtrils.
- i. A Nerve from the ſame branch into the Eye-brows and Forehead.
- H. The trunk of the fifth pair cut off, which tends to the lower Jaw.
- I. A branch of the ſame cut off, which is carried to the Palate.
- K. Its upper maxillar branch.

C H A P. XXIII.

The Description of the eighth Pair of Nerves.

THE Conjugation of the Nerves of the eighth pair, accounted by the Ancients for the sixth, is called the Wandring pair; to wit, for that its Nerve, not content with one member or region of the Body, is thought to respect divers parts, and those different, and situate at a great distance one from another, and to reach forth its branchings, not only in the neighbourhood about the Head and Neck, but through the whole cavity of the middle and lowest Belly, and to most of the Bowels in either. But indeed this nerve hath a province large enough, yet not so diffuse as is commonly thought: for many other nerves, inoculated into this, joyn themselves with it, and are accounted a part of it, although they have distinct beginnings, and going away again from the nerve of the eighth pair, have peculiar divarications, and different from it. Wherefore, that we may give to each its own, we shall endeavour to prosecute this nerve of the wandring pair from the beginning to the end; and also shew the confederations and coincidences or joynings together of others with it.

The eighth Conjugation therefore of the Nerves arises below the auditory or hearing nerves out of the sides of the oblong Marrow, its root consisting of numerous Fibres. In a man there are at least twelve, some of which are greater, others smaller; to which is added a noted Fibre, or rather Nerve, much greater than the rest, from the spinal Marrow, which being joyned with them, and wrapped about with the same Coat, taken from the *Dura Mater*, goes forth together out of the Skull, as if they all grew into one Trunk: but that accessory nerve, yea and many other Fibres, do still remain distinct under that covering, and afterwards departing asunder, are carried into peculiar provinces.

Because this spinal Nerve having passed the Skull, leaving its Conjugation, is carried to the muscles of the Neck and Shoulders; besides, the noted Fibre, out of the beginning of the wandring pair, is presently carried into the hard process of the seventh Conjugation; and two other Fibres, having presently left the company of the rest, go into the muscles of the Throat and Neck: but the rest of the Fibres, being collected together, go forward still as Companions, and instead of their other Companions which departed from them, they presently get new in their places; to wit, sometimes the whole trunk of the intercostal nerve it self, as is seen in most four-footed Beasts, sometimes only a branch of it comes to them, as is observed in Man and some other living Creatures.

In this place where the trunk or branch of the intercostal Nerve is inoculated into the trunk of the wandring pair, a noted infolding is constituted, to wit, the trunk of the nerve being there made greater, seems to be lifted up, and to grow out into a certain Tumor like to a callous or sinewy-swelled body: here, for that it is somewhat long, it is called by *Fallopins* the Olive body; of which sort the same Author affirms, there comes to this nerve sometimes one, sometimes two; but in truth, one is constantly found in the trunk of the wandring pair, but the other in the neighbouring intercostal.

Of these sort of infoldings in general we shall take notice, that they are made in the Nerves, as joynts in a Cane, or knots in the stem of a Tree, viz. as often as a branch goes out of the trunk, or sliding into another place, is received into the same; and when oftentimes some shoots go away from the same place, and others come to it, the infolding there becomes greater; and so the more branches and shoots do happen to come together any where, or to go out of a nerve, the greater the bulk and magnitude of the infolding is increased: but if at any time a branch seems to proceed from any nerve without constituting an infolding, in truth, being included only in the same Coat, it is not accounted so much a branch as a companion, which by a passage long before, had gone together forwards, as a single nerve it self, and distinct enough, nor was it at all inoculated before its departure. But the use of these same infoldings seems to be the same with the knots in the stem of a Tree, or such as the turnings aside or by-paths that lye near cross-ways; to wit, that when the animal Spirits, together

gether with the nervous Juyce, institute divers journies, lest mutually meeting, they should be confounded, they may be able to turn aside a little, and depart one from another till they may recover their orders and just method.

In the Dissection of the Nerves, which are distributed to the *Præcordia* and *Viscera*, the two Ganglioform infoldings, to wit, the aforesaid in the trunk of the wandring pair, and the other near growing in the intercostal nerve, are as it were two bounding stones, which being first diligently traced, the other threads of the Anatomical task, both on this and that side, are easily handled. But that these infoldings may be found, the trunk of the *Carotidick* Artery is laid open on both sides between the Muscles of the Neck; then by following its tract, the aforesaid Olive bodies come into view about the insertion of the lower Mandible; out of which, both the upper beginnings and the lower branchings of either nerve, may be designed or drawn. But because about this place the nerves begin to be figured otherwise in a Man than in Brutes; that the reason of the difference may be known, we will here prosecute apart and distinctly the *Neurologie* or Doctrine of the Nerves of either; and first we shall deliver the *Hypothesis* of the wandring pair, and its confederations with the intercostal and other nerves, as they are found in Man.

The Ganglioform infolding therefore being constituted upon the Trunk of the wandring pair, receives one Nerve sent into it elsewhere, and sends forth another from it self. To this is brought a shoot from the intercostal nerve different from most brute beasts, where the whole trunk of the intercostal nerve comes, and seems to be united to the wandring pair. But from the aforesaid infolding, a noted branch being sent forth, is carried towards the *Larynx*, which when it is divided into three shoots, the first of them is stretched out into the Sphincter of the Throat; the second being hid under the Scutiform or Shield-like Cartilage, distributes its shoots to the upper Muscles of the *Larynx*, and to the Muscles by which the chink of the *Larynx* is shut up; and the third also entring the Shield-like Cartilage, meets the top of the returning nerve, and is united to the same. Such an inoculating of this nerve, with the returning nerve, is constantly found in man and in all other perfect Animals; the reason of which is delivered anon.

Below the aforesaid infolding of the wandring pair, its stem, near the side of the ascending Carotidick Artery, goes forward straight downwards, and in its journey imparts some small shoots to the same, which sometimes compass about the trunk of its Vessel, sometimes are inserted into its Coats. In the lower part of the Neck this trunk of the wandring pair admits a branch of the intercostal nerve from its neighbouring infolding, and in the left side about that place sends forth another nerve from it self into the returning nerve; which cross branch, being stretched out only in the left side, is found in man and all brute beasts: but from thence the trunk of the wandring pair descends without any noted branchings till it comes over against the first or second Rib; where another infolding being made, many shoots and numerous fibres are sent forth towards the Heart and its Appendix. But this divariation of the Cardiack nerves is not after the same manner altogether in either side.

For in the left side one or two noted shoots being sent forth, together with other shoots arising from the intercostal Nerve, are inserted into the Cardiack infolding; but many fibres going out at the same place, are distributed to the Vessels hanging to the Heart, and to its little Ears and *Pericardium*. In the right side a noted shoot going into the greater *Cardiack* infolding, another into the less, and two other shoots from the middle infolding of the intercostal Trunk towards the Cardiack infolding, associate themselves and are united. Besides, numerous Fibres in like manner descend into the Vessels of the Heart and the *Pericardium*. Also the returning Nerve in this side arising higher, is turned back about the axillary Artery, when in the left side the same going away much lower than this infolding, from the Trunk of the wandring pair, compasses about the descending Trunk of the Aorta, and from thence it is turned back upwards.

The returning Nerve, although it seems a branch sent forth from the Trunk of the wandring pair, being indeed a distinct and singular nerve, comes even from the beginning of the wandring pair; yet for better conducts sake it is contained under the same Coat with the rest of the Trunk of the wandring pair. In either side about the knots of reflection or turning back, it sends forth shoots and fibres which are distributed into the Vessels of the Heart. The reflected Nerve in its ascent receives in the left side a branch from the middle infolding of the Intercostal, and another from the

the wandring pair ; but either running back , distributes many shoots to the rough Artery ; then its extremity meeting with the shoot , which is sent out of the Gangliiform infolding of the wandring pair , is united to it.

A little below the coming away of the returning Nerve on the left side from the Trunk of the wandring pair , another noted branch is sent forth on both sides ; which being carried towards the Heart , covering its Basis in the hinder Region , meets it on both sides , and disperses in all its process branches through the whole Superficies of the Heart. As shoots go from these branches into the hinder part of the Heart , so many branches and shoots go from the Cardiack infoldings which are divaricated into its fore-part.

But there are two Infoldings from which the Nerves are distributed into the Heart. The upper and greater is between the *Aorta* and the Pneumonick Artery. The nerves constituting this are one or two noted branches that descend hither from either side the Trunk of the wandring pair ; but chiefly many nerves from either intercostal nerve , to wit , from the midst of its infolding. From this infolding two or three noted nerves are carried under the Aorta into the left side of the Heart. But from this infolding , a shoot being sent forth , making as it were an handle , compasses about the pneumonick Artery ; and a branch descending from the right Trunk of the wandring pair to the exterior part of this handle , and another , which being carried from the nerve which is destinated to the hinder region of the Heart , meet together and make the lesser infolding ; from which nerves are sent into the right side of the fore-part of the Heart.

We are to take notice , That in brute Animals many more and far greater Nerves are carried from the Trunk of the wandring pair into the Heart and its Appendix than in Man , to wit , in whom the chief Cardiack nerves or belonging to the Heart proceed from the intercostal pair , as is shewed below ; wherefore in Brutes , for that reason , the wandring pair affords greater supplies or subsidies to the Heart , because the intercostal nerve scarcely contributes any to it. Further , through the whole tract of the wandring pair , from whence the Cardiack nerves proceed , very many small shoots , being sent forth on both sides , are inserted into the *Oesophagus* and the Glandula's implanted without the *Pericardium*.

From the Region of the Heart , the Trunk of the wandring pair sends forth many noted shoots on both sides , which being carried into the Lungs , are distributed , together with the blood-carrying Vessels , through their whole substance , and in their passage step by step they follow the Pipes of the *Bronchia* , both the Arteries and the Veins , and many shoots being sent forth on every side , they climb upon and compass about these Vessels ; then the Trunk of the same wandring pair , descending on both sides , nigh the sides of the *Trachea* , distributes many shoots also into the Coats of the *Oesophagus*.

Below the Pneumonick branches , either Trunk of the wandring pair going forwards downwards nigh the sides of the *Oesophagus* , is divided into two branches , viz. into the exterior or more outward , and the interior or more inward. Both the inward branches inclining towards one another mutually , do again grow into the same Nerve , which being sent straight down towards the *Oesophagus* , and being carried nigh the inward part of its Orifice , is bent back from thence , and creeps through its upper part. From both branches , being carried nigh the opposite parts of the superior Orifice , many shoots are produced , which being mutually inoculated , do constitute the nervous infolding like a little net. The Stomachical lower branch sends forth very many fibres and shoots nigh the left part of the bottom of the Ventricle , which are united with others , sent forth from the Mesenterick and Splenetick infolding. Further , in the right part of the same bottom of the Ventricle , shoots being sent forth from either Stomachical branch , are united with other shoots sent upwards from the Hepatick infolding ; and about this place either Trunk of the Nerves of the eighth pair seems to be terminated , for that the last that may be perceived of it are some shoots sent forth from the Stomachical branches , which are inoculated or ingrafted with the little branches or fibres sent upwards from the Mesenterick infoldings.

C H A P. XXIV.

The Actions and Uses of the Nerves of the eighth Pair, described in the foregoing Chapter, are unfolded.

AFTER this manner the beginning and branchings out of the Nerves of the eighth pair are disposed in Man: and they are almost after the same manner in Brutes, unless the Cardiac branches be more, because in these they go out only from this one Conjugation. The Figure or Type of all these is well designed or drawn in the ninth Table or Figure. It now remains, recollecting the Tracts of this Description, or at least the things chiefly to be noted, that we inquire into the Reasons of their *Phænomena* or Appearances.

This Nerve, presently after its rise, appears with numerous Fibres, as may be discerned in the ninth Figure *E*: the reason of which is, because many nerves here arising together, and deriving plenty of animal Spirits from the same stock or provision, ought to carry the same to divers parts, and remote one from another; and therefore they assume their *Latex* or Juyce, not at one Trunk, as the blood-carrying Vessels, and afterwards distribute it equally by branches and shoots here and there stretched out; because the Spirits, derived from the same Fountain, have need to flow into these parts separate from them, and variously to transpose and change their influence: wherefore for this business it is required (that we may not suppose little doors in the middle of the branchings out of the nerves, as are in the Pipes of a musical Organ) that the nerves, which are destinated for the performing of divers offices respectively in distinct parts, should be single in their whole passage, and of themselves distinct chanel of Spirits; for the sake of a better conduct many of them are collected together, and seem to grow together into one Trunk; but they are parted both in their beginning, and also in their whole journey, and distinguished, though involved in the same Coat, and so are carried to the respective parts. Otherwise how should it come to pass, that the Spirits to be carried for the performing the instinct of motion towards the Stomach, do not enter at the same time the Lungs or *Præcordia*, and actuate them with an inordinate influence? For indeed the shoots of the nerves of the wandring pair may be followed by the eyes and hand backwards towards the beginning, from the parts into which they are inserted, and where they seem to be united into the same Trunk, so separated with the finger, that it may appear they are single. After the same manner we have plainly separated one from another the returning nerve also, and others, their common Coat being dissected. Yet in the mean time we deny not, that in their progress they do communicate one with another by Fibres meeting mutually, if it be granted, that the same, although they arise together, in their very rise it self are in a manner distinct. For by reason of the nearness of the beginning and progress, though all the nerves of the wandring pair have a certain Sympathy and consent in their actions; yet for that they consist of parted strings, they perform their actions successively, and convey the influences of the Spirits to these parts separate from those.

We have already shewn, that the Nerve of the wandring pair, and others belonging to its family, do serve almost only to the involuntary Function. Wherefore it may be thought, that as there are many shoots and fibres, which going out distinctly from the same origine, are carried to divers parts, that indeed those Bowels and Members, into which these nerves are inserted, do perform their particular actions, stirred up either by the instinct of Nature, or by the force of the Passions, the Animal in the mean time scarce knowing it: yea also, that when certain other nerves, arising afar off, are joyned to this Trunk of the wandring pair, and communicate with it near the very origine of it; this seems to be therefore done, that those nerves, an affinity with the wandring pair being begun, may be drawn into Sympathy with it, and into an unity of action of the involuntary Function. This appears clearly by the accessory nerve from the Back-bone, and some others, as shall be manifested anon.

In the mean time, we shall observe concerning the Fibres of the wandring pair, first that a noted shoot, inclining towards the vocal process of the seventh pair, is
united

united with the same, as in the ninth Figure *c*. Hence a reason may be taken, wherefore in every violent Passion, as of Anger, Fear, Joy, and the like, without the will or intention of the Animal, the Tongue sends forth a voice, as an index of the excited affection; so that not only men, but some brute beasts, in their fleeing or rejoicing, wail, cry out, and make a noise.

Secondly, From the beginning of the wandring pair very many Fibres are distributed into the Muscles of the Neck, Figure the ninth *FFF*. in which there seems little need of the stirring up of spontaneous motions in that part; for to this task the Vertebral nerves serve sufficiently. Notwithstanding the aforesaid Fibres of the wandring pair are the cause why the Neck is moved about in fear, or at any noise or suspicion of danger; and also, why in some Animals, from indignation or pride, the Muscles into which these nerves are inserted, being inflated very much, their necks swell up, and the Crests of many are erected. Of how great use the accessory nerve, coming from the Spine to the wandring pair, is for the pathetick motions of the Arms, shall be shewed presently.

Thirdly, The other Fibres of the wandring pair, being gathered together, seem to grow together into the same Trunk, which presently constitutes the Ganglioform infolding from a shoot coming from the intercostal nerve, as in Figure the ninth *G.H*. And indeed it is very likely, that of these Fibres, which are complicated together in the Trunk of the wandring pair, one is destinated to the returning nerve, another to the *Præcordia*, a third to the Lungs, and lastly, another to the Ventricle; all which, although they have communication among themselves, and for the sake of a better conduct are gathered together in one, yet they are still distinct from their very original, and constitute divers passages of the animal Spirits.

But that a shoot is carried from the intercostal Nerve into the upper infolding of the wandring pair, as in the ninth Figure *b*; the reason is, that between these nerves a certain strict affinity and kindred might be, and that either of them might be affected with the others offices. For as the nerve of the wandring pair distributes shoots chiefly to the *Præcordia*, and the Stomach, and the intercostal Nerve to the rest of the *Viscera* of the lower Belly; we may observe, that between all these there are not only some commerces, but Sympathies, and a consent of Actions and Passions; wherefore there is a necessity, that the nerves designed to either parts, should communicate among themselves. Further, in Man the intercostal nerve imparts to the Heart and its Appendix more shoots and fibres than the nerve of the wandring pair: wherefore these nerves do not only communicate by these superiour infoldings, but also again a little lower by a shoot sent out from the cervical infolding, or that of the Neck.

From the aforesaid infolding a noted branch of the wandring pair is sent forth into the Muscles of the *Larynx*, a certain branch of which, entring the Shield-like Cartilage, meets with the returning nerve, and is united to it *Fig. 9. b*. It will not be difficult to collect what the use of this nerve may be; for seeing the *Larynx* or the rough Artery serves both for the drawing in and putting out of the breath, and also for the modulating the voice; for either office that its Trunk, like the folds in a pair of Bellows, may become sometimes more short, sometimes more at length, these same ringy Cartilages ought to be pulled together, or contracted sometimes upward, and sometimes downward. That a flat voice or sound might be formed, they ought to be prest down as much as may be to the bottom; but if you would form a more shrill or sharp sound or voice, the superiour Rings are lifted up; to wit, that the sound might be broken but only in the very passage of the Jaws. For the performing of this double motion of the *Larynx* two nerves are constituted like the hands of a Piper, one of which stops the lower holes, the other the upper of the Pipe: to wit, the shoots and branches of the returning nerve being lifted up from below, move the ringy Cartilages downwards; and the nerve sent out from above from this infolding, presently draws the more superior upwards. Further, because a certain consent and joynt action is required in both nerves, therefore they are mutually inoculated or ingrafted: yea, whenas either of them returning, distributes frequent shoots into either side of the *Trachea*; it seems that those that are sent out into the right part, move its Rings downwards for Inspiration and a strong Voice; and the others, going out on both sides into the left part, carry the Rings upward for Expiration and for an acute or sharp Voice. Moreover, as the instinct for the motion of depression or pressing down is delivered from the knots of the recourse or reflections; so the impression,

pression, for the elation or lifting up of those parts, is received from this nerve of the *Ganglioform* infolding.

A noted branch from the middle infolding of the intercostal Nerve is carried into the Trunk of the wandring pair, *Fig. 9. i.* For what end that is so, we have shewn already; to wit, that the commerces of the Spirits dwelling in both nerves, might be strengthened: but it should be noted, that it is only so in the left side where the Trunk of the wandring pair shews it self single for a long space; but in the right side, where the returning nerve goes from it much higher, here the other nerve from the intercostal infolding is plainly wanting.

About the Region of the first or second Rib, another noted infolding appears in the Trunk of the wandring pair, from which many shoots and fibres are sent towards the Heart and its Appendix, *Fig. 9. k.* Further, in brute Animals, about this place, the intercostal nerve leaves the Trunk of the wandring pair. Without doubt, some animal Spirits go apart in this infolding, which are destinated to the anterior region of the Heart, also to the *Pericardium* and some of its Vessels, whilst other Spirits pass through, which a little lower are derived into the hinder region of the Heart; and which being yet carried further, go to the Lungs, and lastly to the Ventricle.

We may observe, that from the aforesaid infolding of the wandring pair numerous shoots and fibres are sent forth, which are distributed into the little ears of the Heart and all the sanguiferous Vessels belonging to the Heart, *Fig. 9. l. m.* which fibres and nervous shoots creeping along like Ivy, thickly cover over the Coats of the Vessels, and enter them in very many places, and variously bind them about. Truly this copious distribution of the nerves doth effect the pulsifick force in the little ears of the Heart and in the Arteries, or at least seems to excite it; and so to erect and strengthen those parts by a continual influx of the animal Spirits through these nerves, that they may be able to sustain an undiscontinued reciprocation of *Systole* and *Diastole*. Moreover, that the thick fibres and shoots of the nerves are inserted both into the Veins and Arteries, and bind both those kind of Vessels, and variously compass them about, we may lawfully suppose, that these nerves, as it were Reins put upon these blood-carrying Vessels, do sometimes dilate, and sometimes bind them hard together for the determining the motion of the Blood according to the various force of the Passions, or to deduce it here and there after a manifold manner; for by this means it comes to pass, that in fear the excursion of the blood is hindred, and in other Affections its motion is respectively altered.

But that many shoots and branches are inserted into the *Pericardium*, it seems to be for this use; to wit, that that little Chest which is made like a Fort for the defending the Heart from injuries, as often as any troublesom matter assaults or besieges it, might be able to draw it self together, and to shake off the enemy. For it seems, that the inordinate tremblings and shakings of the Heart, which are manifestly different from its natural Pulse, proceed from the violent shaking of this Membrane.

As to the Cardiac branches sent from this infolding we observe, that they, because destinated to a publick office, do therefore communicate and enter into the pairs of either side before they are inserted into the Heart; for which end the infolding is made before the Basis of the Heart, where the aforesaid shoots, from the wandring pair and many others, going out from either intercostal nerve, meet together. From that infolding, placed between the *Aorta* and the pneumonick Artery, very many branches being sent forth above, cover over the Hemisphere of the Heart: but yet from these certain branches, carried under the *Aorta*, are brought into the left side of the said Hemisphere; and as other pairs tend towards the right side, one of the first of them, making a little handle, binds about the pneumonick Artery; then meeting with other Cardiac shoots, makes the lesser infolding, out of which branches are sent forth into the right and anterior side of the Heart. That from the greater Cardiac infolding, nerves departing one from another, do institute contrary journies towards the Heart, it is indeed, that they might come to divers regions of the Heart without meeting one another, and might affect its Vessels respectively in their passage; to wit, the branches carried this way, insert their shoots into the *Aorta*, and from the others going that way, one compasses about the pneumonick Artery. The reason of both seems to be, that the blood might be either sooner or slower drawn from the bosoms of the Heart for its various need or necessity. For whilst the aforesaid nerves do both sustain its motion by their influx, and also moderate and temper it by their instinct, it so comes to pass from thence, that those

Vessels also, being affected by the same nerves, do further compose themselves to the requisite Analogies and proportions of the Pulses.

Indeed there are many Nerves, and those conspicuous enough, which are inserted into the Heart, and cover its outward substance with shoots sent forth from all sides; yet it is not to be thought, that these nerves alone perform and sustain the undiscontinued motion of the Heart: because so small little ropes seem too unequal for the perpetual agitation of such a Machine. Yea it may be observed, that more shoots and fibres of nerves are distributed into the little ears of the Heart and the depending Vessels, than into its frame or substance. Further, it is obvious to any that will behold it, that there is a greater plenty of nerves destinated to the Lungs, Liver, Spleen, Ventricle, or Reins, than to the Heart it self; so that some Anatomists (as *Fallopins* says) were doubtful, whether there were any nerves that belonged to the Heart or not. But this being clear enough, that we may describe the motive power of this Clock or Machine stirred up by the help of some small nerves, as it were an explosive motion, we say that the substance of the Heart it self consists of a very fibrous flesh, and may rather be called a Muscle than *Parenchyma* or congealed substance: wherefore in this, as in other Muscles, the implanted and proper fibres cause the local motion and constant shaking; but by the inserted nerves is only conveyed the instinct of the motion or action; for the performing of which office, both fewer Nerves and fewer animal Spirits flowing in through their passages, do suffice. But indeed we suppose, that the animal Spirits implanted in the Heart, and abiding within its Fibres, did at first flow thither through the nerves, and that by this way their expences or loss are made up or supplied; yet that the animal Spirits, which seem to be dispensed to the Heart by so sparing an hand, may suffice for the actuating this perpetual motion, they receive continually subsidiary Forces from the arterious blood. For elsewhere we have shewed, that in the Heart, as in the whole musculous stock besides, a sulphureous Copula, from the suggested blood, is joyned to the spirituous saline Particles of the implanted Spirits; which matter, whilst the Spirits are agitated, being at length struck off, and as it were exploded (just like the rarified and inkindled Particles of Gun-powder) for the effecting the motive endeavour, do blow up or intumesc the Muscle or the Heart it self; and so from the indiscontinued action of the Heart much of this sulphureous Copula, which is easily supplied from the blood, and less of the Spirits, which are brought by the passage of the nerves, is bestowed.

And here it may be rightly inquired into, whether the Pulse of the Heart so necessarily depends on the influence of the animal Spirits through the Nerves, that it being hindred, the action of the Heart should wholly cease? For the decision of this, we once made a tryal of the following Experiment upon a living Dog. The skin about the Throat being cut long-ways, and the Trunk of both the wandering pair being separated apart, we made a very strict Ligature; which being done, the Dog was presently silent, and seemed stunned, and suffered about the Hypochondria convulsive motions, with a great trembling of the Heart. But this affection quickly ceasing, afterwards he lay without any strength or lively aspect, as if dying, slow and impotent to any motion, and vomiting up any food that was given him: nevertheless his life as yet continued, neither was it presently extinguished after those nerves were wholly cut asunder; but this Animal lived for many days, and so long, till through long fasting, his strength and spirits being worn out, he died. The carcass being opened, the blood within the Ventricles of the Heart, and the Vessels on every side reaching from thence, to wit, both the Veins and Arteries, being greatly coagulated, was gathered into clotters; to wit, for this cause, because the blood, though for the sustaining of life, it was in some measure circulated, yet for the most part it stagnated both in the Heart, and in the Vessels. The cause of which stagnation I can assign to no other thing, than that the *Præcordia*, the influence of the animal Spirits being hindred, wanted its usual motions.

If it should be further demanded, from whence the animal Spirits (the passage of both the wandering pair being shut up) should be supplied to the Heart continuing still its motion; I say, that this may be done by the returning Nerves, as from the knots of which many Cardiack shoots and fibres proceed; and besides, the end of either nerve meeting with the nerve sent from the upper infolding, is united. But we shewed already, that the animal Spirits may be carried either this way or that way within the passages of the nerves; wherefore when the necessity of life urges, the provision of the Spirits, though lesser, being sent from the aforesaid infolding, is received

received by the tail of the returning nerve, and from thence by a retrograde passage it was derived into the Cardiac branches, and at length into the Heart it self. Further, there lyes open also another passage, and that perhaps more obvious, through the passage of the intercostal nerve: by this way in a man, as well as by the passage of the wandring pair, the Spirits are conveyed from the Brain to the *Præcordia*; yea also in Brutes a branch is carried into the Trunk of the wandring pair from the intercostal infolding; so that by this by-path some little rills of the animal Spirits (if by chance their influence should be hindred through their wonted chanel) might be carried to the Heart. However that Experiment seems to conclude, that the motion of the Heart depends no less upon the inflowing of the blood, than upon that of the animal Spirit: the total privation of either takes away life; an Eclipse of the Spirits wholly takes away from the Heart its motive power; and by the defect of the blood (forasmuch as the sulphureous Copula is denied to the Spirit implanted in the Heart) the vigour and elastick force of the Heart is supprest, so that the Pulse being by degrees weakened, life is by little and little extinguished. Without doubt, in the finding out the tenour of the Pulse, we ought always to mind what the alteration of the animal Spirits, and what the fault of the blood may bring to it.

There is yet another consideration concerning the Nerves reaching from the Trunk of the wandring pair to the Heart, to wit, that by their passage, not only the solemn influence and state of the Spirits, for the equally performing of the vital Function, is conveyed; but also the instinct of every irregular motion, stirred up in the *Præcordia* by the force of the Passions, is in some measure transferred this way. I say, as to these, we ought to discourse and to shew by what means, as often as the impression of any Affection exercises the Imagination, or rather the Appetite, presently the *Præcordia* are disturbed by the passage of the Nerves, and by reason of their various Affections the motion of the blood is diversly altered. But because in a man the irregular and extraordinary motions of the *Præcordia* depend on the intercostal Nerve as much as and perhaps more than on the wandring pair; therefore we think good to defer this Speculation till the Theory of that Nerve is proposed. In the meantime, we will proceed to the other branches of the wandring pair; and what next follows, we will inquire into the offices and uses of the returning Nerves.

The returning Nerve in the left side, going away from the wandring pair below the aforesaid infolding, and sent towards the *Aorta*, is reflected or turned back about its descending Trunk, from whence being carried upwards, it imparts shoots to the Muscles of the *Trachea* and the *Larynx* sent forth by a long tract from either side of the Nerve; then its top or height is united with a shoot meeting it out of the Ganglioform infolding, *Fig. 9. n. **** b.* But the returning Nerve on the right side is reflected much higher about the axillary Artery, to wit, proceeding from the lower infolding of the wandring pair, and after the same manner is bestowed on the other side of the *Trachea*, *Fig. 9. L.* But either returning back about the knots of reflection, sends forth towards the Heart very many shoots and fibres, which are inserted into its little ears, the appending Vessels or its Infoldings.

What the chief use of this Nerve is, we have already shewn; to wit, being rolled about on both sides the Artery, as it were a Windlace, it causes the little rings of the *Trachea* or Weasand to be drawn hither and thither, like the folds of a pair of Bellows, both for breathing and making a sound. But indeed either Nerve, forasmuch as it being reflected about the Artery, is carried upward into the part to be moved, doth move downwards the little rings of the *Trachea* or Wind-pipe by certain shoots of it; also forasmuch as either is terminated in the Nerve, sent from the Ganglioform infolding, it carries upwards the folds of the *Trachea* by other shoots of it. Hence a reason may be given, why the returning Nerves being cut off, every Animal is presently dumb; to wit, because, unless the *Trachea* be moved, the breath being blown out, passing without any refraction through its cavity, as it were through a Pipe alike hollow in its whole passage, gives no sound.

Concerning these Nerves we ought to inquire, what is the reason of the difference, that the knots of reflection are not alike on both sides; also for what end the Cardiac branches proceed from both knots. As to the first, that the left returning Nerve, not as its pair, binds about the axillary Artery, some reason seems to be, because the left axillary Artery, arising below, is carried as the right, by a bending, and not a straight passage, into the Arm; wherefore the little cord of the Nerve, compassing about its Trunk, hath no fixed, but a very moveable knot of reflection,

for that it might easily slide from its place. But it may rather be said, that it is for other uses, and those more necessary, that these Nerves compass about those Vessels after that manner. For when they, as it were Reins or Bridles cast on the blood-carrying Vessels, by pulling them hither and thither, variously determine the course of the blood, it seems to be required, that one returning Nerve should bind together or constrict the axillary Artery, and the other the descending Trunk of the *Aorta*: for as often as there is need for the blood to flow forwards towards the Head more plentifully, the returning Nerves perform it easily, by pulling upwards the aforesaid Arteries: But the blood, after a sort, ought to be continually urged into the higher parts, lest otherwise by its weight it should turn too much downwards; wherefore in all Expiration or breathing forth, when the *Trachea*, drawing nearer together its folds, is contracted upwards, the blood about to descend through the *Aorta*, is snatched upwards by one tract of the nervous little cord, and in like manner, the axillary Artery in the right side being shaken with it, the blood flowing in the whole ascending Trunk of the *Aorta*, is driven upwards a little swifter.

But besides this continual and equal snatching up of the blood towards the upper parts, it is sometimes occasionally urged towards the Head by a more intense and quick motion of the *Trachea*, and also by a more full and swift course. For as often as any Animal grows angry, the voice presently shews signs of such an Affection, and oftentimes by chiding, they make it sharp; as men, when they are angry, chide or brawl, and Dogs bark: Now from such an intension of the voice and chiding, as the upper rings of the *Trachea*, a reciprocation being there made, are often struck together; so the blood also (the *Aorta* being strongly drawn) is urged upwards by a copious afflux, so that it presently dyes the countenance and eyes of angry people with a redness, and induces to the Brain it self a greater heat and provocatives to anger, and a greater glowing or inflaming to the Spirits by stirring them up. For the same reason, in Joy and Gladness, soasmuch as the *Trachea* is exercised by singing or laughing, the blood also is poured out more plentifully towards the exterior, and especially the upper parts.

And from hence the cause is plain, wherefore either returning Nerve sends forth Cardiac branches from the knot of reflection or turning back; to wit, that in those kind of affections, the notice of which the *Trachea* in sounds or voices gives by the help of the Nerves, the Heart it self by its means also might be affected. For so, as often as we wrangle or brawl, the Heart being irritated, presently inkindles the blood more, and drives it forward more plentifully, as food for those Affections, towards the Brain. Also in laughter, great rejoicing, or singing, by the passage of those Nerves, the Heart being brought into a consent or Sympathy, or joyned action, presently explodes or drives out the blood by a swifter pulse, and casts it hastily out, which otherwise would be heavy and troublesome by a slower motion or stagnation; wherefore those sort of actions, to wit, laughing and singing, are said to alleviate the Heart, because they make the blood more freely and readily to be poured out of the bosoms of the Heart, and also, by the supplying help of the Lungs, to be emptied into the same.

Below the production of the left returning Nerve another noted Nerve is carried towards the hindermost region of the Heart, which being carried with a certain compass about its Basis, sends forth frequent shoots, which cover the left side of the hinder Hemisphere, *Fig. 9. o.* Then this branch meeting with another pair sent from the opposite side towards the Heart, and distributing shoots into the right side of the hinder Hemisphere, is united with it, *Fig. 9. q.*

This Cardiac branch, destined to the hinder region of the Heart, is produced apart below the rest, that it might be carried by it self to its Province without the meeting with or implication of others; the pairs are ingrafted on either side, that they might accompany one another; and be together drawn in the same action of the Heart. It appears not plain, whether these nerves conspire with the other Cardiac nerves, arising above, reaching forth to the anterior Hemisphere of the Heart; or whether this pair effect not the *Systole* of the Heart, and the upper its *Diastole*. However it is, certain shoots of the kindred or stock of either, being ingrafted with others of another stock, communicate one with the other.

The Trunk of the wandering pair sends forth on both sides very many noted branches from the region of the Heart, which are spread on every side into all the Lobes of the Lungs, the *Bronchia* of the *Trachea*, and the Coat of the *Oesophagus* hard by descending,

descending, *Fig. 9. s.s.s.* Those which go into the Lungs pass every where through their whole substance, following the ramifications of the Veins and Arteries, and the Pipes of the *Bronchia*, which chanel of blood and air they variously climb over, and bind about through their whole tract.

When that so many noted branchings of the Nerves are bestowed on the Lungs, it is a wonder, that by some they should be thought to be insensible and immoveable of themselves. Yea it is doubted by many, whether these Bowels do cause the motions of the *Systole* and *Diastole* of themselves by their own endeavour. For that it is a received Opinion, That this reciprocation of the Lungs doth proceed wholly from the motion of the *Thorax*, and doth obey or observe its dilatation or constriction with a certain necessary dependency; *viz.* that the Breast being dilated or spread open after the manner of a pair of Bellows doth compel the ambient Air into the *Trachea*, which rushing into the Lungs, blows up and distends them; then the same Breast subsiding or sinking of it self, that the Lungs being pressed together with the weight of it, do breath forth the Air before intruded. In truth, however that I might judge, that the *Diaphragma* and the Muscles of the Breast do conduce much to Respiration; yet that these parts should perform this office alone, and that the Lungs are merely passive, I cannot grant. For Respiration is chiefly instituted for the sake of the blood and the Heart, and its act is wont to be determined according to the various disposition of these, and to be altered every minute of an hour almost according to the manifold necessity of the Pulse. But indeed the Lungs themselves are they (and not the *Diaphragma* or the Muscles of the *Thorax*) which the blood, boiling out of the Heart, passes through, and continually affects according to its temper, and the tenour of the Pulse: wherefore from hence it may be concluded, That the Lungs themselves do conceive the first instincts of their motions, and by the help of the aforesaid Nerves, do in some measure exercise themselves, and endeavour the *Systole* and *Diastole*, and design them according to the sense of its proper necessity; but when in these, Fibres requisite for local motion are wanting, therefore the *Diaphragma* and the Muscles of the *Thorax* help continually the endeavours of the Lungs, and by the cooperation of these, compleat breathing is effected. And so when Nerves of a twofold kind, to wit, some from the Spine being inserted into the Muscles of the *Diaphragma* and the *Thorax*, and others from the wandring pair distributed into the Lungs, actuate the Organs of Respiration; for that reason it comes to pass, that the act it self of Respiration, of it self unforced and involuntary, may be at our pleasure somewhat restrained, interrupted, and diversly altered. The *Sympraxis* or joynt action of the Nerves of either kind, in the work of Respiration, shall be shewed hereafter, when we shall speak particularly of the Nerve of the *Diaphragma*.

It yet appears more plain, that the Lungs are oftentimes the chief in the act of Respiration, because they being irritated from strange and improporionate objects, presently conceive irregular and violent motions; as when a vehement Cough is stirred up for the exclusion of any troublesom thing; to which motion the *Diaphragma* and the Muscles of the *Thorax* presently obey. In like manner, in difficult and sighing breathing, or any other ways unequal, its first instinct for the most part is begun by the Lungs; yet sometimes when the exterior Organs of Respiration are excited into irregular motions, the Lungs also are compelled to follow their irregularities; so when the *Diaphragma* after a manner begins laughter, the Lungs perform the same with a following cackling sound: so all the Organs of Respiration intimately conspire and agree among themselves, that although one of them do a thing inordinately, rather than there shall be a Schism, the rest do imitate or follow its irregularity.

But that the Nerves, following the Arteries and Veins through the whole frame of the Lungs, do variously bind about and cloath their Trunks with a thick series of shoots, the reason seems to be, both that the Coats of the Vessels being gifted with a constant influx of animal Spirits, might imitate the motion of the Heart; and by that means, by a continual pulsation of the Arteries and the constriction of the Veins, they might easily carry the blood in this its more short lustration through the Lungs; and the rather, that the pneumonick Vessels, being bound about with such Reins of Nerves, might moderate the course of the blood according to the forces and instincts of the Passions. For whenas the exterior circulation of the blood depends upon this interior; as the blood is commanded to pass sooner or slower through the Lungs,

Lungs, or to stay there and be hindred, the excursion and return of it also from or towards the Heart is wholly performed. In Joy or Anger, because the Lungs rapidly transfer the blood out of one bosom of the Heart to the other; therefore its swifter and more plentiful flowing out into the outward parts, follows. In like manner, in Fear and Sadness, for that the Lungs (its Vessels being strained together) deliver the blood to the Heart by the Veins, and do not then presently carry it back by the Arteries, the outmost region of the Body is destitute of its due influx. Notwithstanding these kind of pathetick snatches of the blood are in some measure performed, because its Vessels are bound about in other places in like manner with the Nerves. If at any time Spasmodick Affections should afflict the pneumonick Nerves from a morbid cause, so that being twitcht with inordinate motions, they should pull or draw together here and there the Arteries and Veins which they embrace; for that cause, the blood either too much flowing out of the Lungs, makes them to flag, and to fall together into themselves, so that drawing to them copiously the Air, they do not easily render it back again; or, which frequently happens, the blood being detained within the Lungs, and there stagnating, stuffs them up, and holds them a long while stiff, that they cannot inspire or draw in the Air. The Symptoms of either kind ordinarily happen in the Hysterick distempers, and in some Hypochondriacal. Yea sometimes the *Bronchia* themselves are pulled together by the like Convulsion of the Nerves, and are hindred in their motion, so that they cannot take in and send forth the Air after its due manner, as may be seen in Asthmatical Fits. The distempers of which sort are oftentimes produced by the fault of the Nerves, without any implanted Dyscrasie or evil disposition of the Lungs. I have sometimes observed some Cases of sick people, in which, when at one time the morbid matter besieging the Brain, had induced Lethargick or Vertiginous Symptoms, a little after the same matter occupying or possessing the origines or middle processes of the nerves belonging to the Lungs, has suddenly excited a most horrid Asthma without any previous Cough or Catarrh.

But that out of the same tract of the wandring pair many shoots are distributed into the Lungs, and also many others into the Coats of the *Oesophagus*; from hence a reason may be given, why a troublesom Cough oftentimes causes Vomiting and a subversion of the Ventricle; why also on the other side a perturbation of the Ventricle so frequently induces a troublesom endeavour of Coughing. I have known in Hypochondriacks, that aliments of ill digestion, taken into the Stomach, have presently excited a vain and very pertinacious Cough; in the mean time, that the Lungs were free from any consumptive disposition. The cause of either distemper seems to be, that when the nerves, disseminated in either part, are taken with a Convulsion, oftentimes those which are of the other part, are drawn into a consent of the same distemper. Perhaps from hence it happens, that sometimes an Asthma is induced by reason of the evil of the Ventricle, and that that distemper (as *Riverius* observes) is often wont to be cured by an emetick Medicine.

After so many branches and shoots have been sent from both sides the wandring pair, at length its Trunk is divided below the Lungs into two branches, *viz.* the exterior and interior; either of which inclining towards the pair of branches on the other side, are united to them, and after a mutual communication they constitute the two Stomachical branches, *viz.* the superior and the inferior, *Fig. 9. t. u. w. x.*

It is worth observing, with what wonderful artifice either Trunk of the wandring pair do communicate one with the other with two branches, as it were two hands meeting one the other, that the influence of either nerve might equally reach to every region and part of the Stomach. For whenas either Stomachical branch, to wit, both the upper and the lower, is carried together from the two branches coming out from either side of the wandring pair; it is provided, that the Tributes of the Spirits destinated to the Ventricle, should be at once certain and very plentiful. For what appertains to the performing the action of this Bowel or Chylification, the Spirits flowing in from either side, are abundantly distributed into the Orifice, and from thence into all its parts and private places; and by that means it comes to pass, that the Stomach dissolves bodies beyond the force of any Chymical Menstruum. Then besides, as to the feeling or sense of the Ventricle, or the affection of it from things ingested; it is carried also towards the Head by a double way (whereby the passage may be the more certain) to wit, by either Trunk of the wandring pair; that for that reason being indued with a most exquisite sense, it might not be deceived concerning

cerning its objects; and if that any thing inimical or contrary to it, should lye hid among what is eaten, it might discern it and thrust it out of its own accord, or at least by the knowledge only of the Cerebel.

That from the same double Trunk of the wandring pair, from whence the Cardiac Nerves arise a little above, the Stomachical branches also proceed, the cause is plain wherefore the Heart it self hath such a Sympathy with the Stomach, so that its *Deliquium* or Swooning follows upon any great pulling or hawling of this.

Either Nerve of the wandring pair is terminated in the Ventricle it self: for after the eighth Conjugation hath made as it were an high road for the passage of the animal Spirits to the *Præcordia* and to this noble Bowel, it puts a bound to it self; nor indeed does it seem meet to have its branches stretched out any further to the *Viscera* of the lower Belly: because it seems an unworthy thing, that the same path which leads to the chief office of nutrition and to the Palaces of life it self, should lye open to the more vile Intestines also, and the sink of the whole Body. And truly, although the ample path and broad way of the wandring pair is not produced beyond the Ventricle, yet because a frequent commerce happens between this and the *Præcordia* and the other inferior parts; therefore between the Stomach and the other Bowels, though of a more base use, certain Fibres, as it were smaller paths, are reached forth, in which, at least little bands of Spirits, like Discoverers or Messengers, run to and fro.

C H A P. XXV.

A Description of the Intercostal Nerve.

After the unfolding of the Nerve reaching forth to the *Præcordia* and the Ventricle, we are led by the series or order of the inward parts to the describing a Nerve akin to this, and which reaches forth its branches to the furthestmost Province, to wit, to all the *Viscera* or Inwards of the lower Belly contained below the Ventricle. This is commonly called the Intercostal, because that going near the roots of the Ribs, it receives in every one of their Interstices a branch from the spinal Marrow. Its beginning is not yet sufficiently detected; for by most Anatomists it is wrongfully taken for a branch of the wandring pair, though indeed the wandring and the intercostal pair do communicate among themselves by branches sent forth one to the other; yet as to both their beginnings, Trunks and wandrings up and down, they are plainly distinguished. If that this latter Conjugation, being denied the title of a peculiar nerve, ought to confess it self of another stock, certainly it owes nothing to the wandring pair, but should borrow its original from the Nerves of the fifth and sixth pairs; for two or three shoots being sent back from those nerves going out towards the Eyes and Face, go into the same stock or Trunk, which is the Trunk of the intercostal nerve, as we have intimated before.

The intercostal Nerve being constituted after that manner, and going out of the Skull at a proper hole, presently contains the Ganglioform infolding, near to another the like infolding of the wandring pair; into which two nervous Processes are carried from the last pair within the Skull, or the first Vertebral. From that infolding one shoot is sent forth into the Sphincter of the Throat, and another noted one into the Ganglioform infolding of the wandring pair. Then this nerve descending towards the *Vertebrae*, hath in the middle of the Neck another far greater infolding, into which an ample nerve, from the neighbouring Vertebral pair, is inserted; but from the same many nerves, which respect the *Præcordia*; are distributed on every side: For two or three shoots are sent forth into the nerve of the *Diaphragma*, and one shoot into the returning nerve; besides, numerous fibres and shoots are carried both into the returning nerve, and towards the *Trachea*, which are inserted into its Coats, and into those of the *Oesophagus*, and into the blood-carrying Vessels. Further, one branch descends into the Trunk of the wandring pair, and two noted nerves into the Cardiac infolding; then a little lower another nerve by it self, proceeding out of the intercostal Trunk, is inserted also into the Cardiac infolding: which noted branches sent down on both sides from the intercostal nerve, for that they joyn together

together with others derived from either Trunk of the wandering pair, make the Cardiac infolding it self. But these Cardiac branches from the intercostal nerve, as also the Cervical infolding, or that in the hinder part of the Neck, whence they proceed, are peculiar to men, and are wholly wanting in brute beasts.

The intercostal Trunk descends from the cervical infolding towards the chanel-bone, where being about to enter the cavity of the Breast, it falls upon the axillary Artery, as it were in right Angles, and strains or binds it; from whence it is drowned or hidden in the *Thorax* near the roots of the first and second Ribs; and there receiving three or four branches from the Vertebral nerves next to those uppermost, constitutes another infolding, which is commonly called the Intercostal infolding. The uppermost of these Vertebral nerves coming to this infolding in its journey binds the Vertebral Artery, and almost compasses it about. In Brutes by this nerve which comes upon the Vertebral Artery, the intercostal infolding communicates with the root of the nerve of the *Diaphragma*, and not by any other means, unless by small fibres sent forth from the lower part of the infolding into the Vertebral nerves. Further, in Brutes a noted branch is carried from this infolding into the Trunk of the wandering pair. But in Man the intercostal Trunk passes through the cavity of the *Thorax* without any communication had with the other parts; unless that from hence in its whole descent, running near the roots of the Ribs, it admits in every one of their interspaces, and from thence even to the *Os sacrum* from between the knots of the *Vertebrae*, a Vertebral branch.

The intercostal pair sends forth a noted branch on either side, where having gone through the cavity of the *Thorax* or Breast, it comes over against the bottom of the Ventricle, which tending towards the *Mesentery*, constitutes the chief infoldings of it. But there are seven Mesenterick infoldings, viz. five great superior, and two less inferior: out of all which, numerous shoots and fibres are sent forth together into the parts which they respect, and into the neighbouring infoldings. The Mesenterick nerves, which are carried into these infoldings, and the infoldings themselves, and also the fibres and shoots, which flow out from them on every side, like rays of light, are disposed according to the following manner both in Man and in the more perfect Brutes.

The Mesenterick branch therefore in the left side going from the intercostal Nerve, and bending downwards, is parted into two noted shoots: the greater of these bending back upwards towards the Stomach, diffuseth it self presently into an infolding, as a narrow rivulet into a spacious Pool. From this infolding numerous fibres and shoots go forth as it were in four bands. The first of these, and which is the greatest bundle of its fibres, being carried into the Ventricle, is bestowed partly in the bottom of it, and partly these fibres are met, and ingrafted with others sent from the Stomachical branch. The other maniple or band of nervous Fibres goes forth from this infolding to the Spleen, where the nerves accompanying the sanguiferous Vessels, and variously binding them about, are dispersed into the more inward frame or substance of the Spleen; yet out of which going towards the Spleen, some shoots following the short Vessels, are carried into the Stomach. The third Company of nervous Fibres is inserted between this infolding and the Hepatick or that belonging to the Liver, placed in the right side over against it. Lastly, the fourth Conjugation of Fibres knits together this and the greatest infolding of the Mesentery lying under it.

The lower shoot of the Mesenterick branch, which is on the left side, increases into an infolding, to which the next Vertebral branch, destinated to the intercostal Nerve, is carried. From this infolding the chief bundle of nervous Fibres is carried into the left Kidney, and before the Fibres enter the Reins, they bind and variously compass about the emulgent Vessels. Further, between this infolding and the greatest of the Mesentery many Fibres are stretched out; from hence also many shoots are distributed into the atrabiliary Chest, or the Receptacle of the Spleens excrements.

In the right side the Mesenterick branch being sent from the intercostal Trunk, and being in like manner twofold, contains in its upper shoot the Hepatick infolding; out of which the greatest bundle of nervous Fibres is carried towards the Liver; numerous shoots of which accompanying the blood-carrying Vessels, greatly beset, and as it were cloath with a little net the Trunk of the Hepatick Artery: which fibres and shoots, being carried higher, are distributed into the Liver, the Gall-chest or bag, the passage of the Gall, the Pylorus, and the Pancreas. Further, many Fibres, which are of this Conjugation, meet with Fibres sent from either Stomachical nerve, and

are ingrafted into them. Another handful of nervous Fibres is stretched out between this infolding and the opposite infolding belonging to the Spleen, and another between this and the greatest infolding of the Mesentery; yea, there is some communication had between this and that belonging to the Kidney lying under the same side by a large shoot sent down.

The lower shoot of the right Mesenterick branch, like as it is in the opposite side, contains a sufficiently noted infolding nigh the atrabiliary Chest; to which presently the intercostal Nerve imparts its Vertebral branch received below. From this infolding the chief bundle of nervous Fibres destined to the Reins, embraces the blood-carrying Vessels in like manner as in the opposite side; also many fibres and shoots are stretched out from this infolding to those near, *viz.* the Hepatick and the greatest of the Mesentery; yea, certain Fibres are dispersed from the same into the atrabiliary Chest.

After this manner either Mesenterick branch being carried from the Intercostal pair, and being presently twofold, immediately constitutes two infoldings in either side. In the midst of these the greatest infolding of all stands like the Sun in the midst of the Planets; from which numerous shoots and fibres are dispersed into all the parts of the Mesentery; which indeed following the blood-carrying Vessels in their whole process, climb over and bind about the same. Moreover, between this infolding and every one of the four aforesaid is produced a peculiar little bundle of Fibres. Besides, in the female Sex, from hence some shoots are carried into the Glandula's of the Womb, commonly called the Stones. But from the Mesenterick branches, which constitute the former infoldings, no noted branches, but only little shoots, are sent into this infolding. Yea the chief Nerve which is inserted to this, and seems to be the primary for the conveying of plenty of Spirits into it, and a broad way, is carried from a certain small infolding far lower nigh the straight Intestine; which infolding, together with the other neighbouring one, that we call the lesser infoldings of the Mesentery, shall be described presently. In the mean time, that we may proceed to them in order, we will follow the passage of the intercostal Nerve.

Below the Mesenterick branches, from which the aforesaid superior infoldings are constituted, the intercostal Trunk descends between the Muscles of the Loyns, and bestows every Vertebral branch, admitted in its descent, upon some internal parts.

For the Vertebral branch brought to the intercostal Trunk nigh both Kidneys, is carried into the Womens Testicles, then some following into the Ureters. From the Region of the twenty seventh *Vertebra* one Vertebral branch and two others, going from the intercostal Trunk, tend towards the straight Intestine, and there they meet with three pairs sent from the other side; all which being united, constitute the infolding, which is the lowest of the Abdomen. From this infolding a noted Nerve, being carried upwards, is brought into the greatest infolding of the Mesentery, which in its journey receives one and then another shoot sent down on both sides from the intercostal Nerve; and there, near its bounds, distributes some shoots into the Glandula's of the Womb.

But from the lowest aforesaid Infolding, a Nerve going towards the upper Infoldings, about the space of an inch, constitutes another lesser infolding in the neighbourhood; out of which one Nerve tends upwards, and another opposite straight downwards. The former of these is carried into the greatest infolding of the Mesentery, and in its whole passage stretches under the straight Intestine, and part of the *Colon*, and inserts into them many small shoots. But the other Nerve descending from this infolding towards the *Anus* under the inferior part of the straight Intestine, imparts to it also frequent shoots; so that this infolding, the least of all those which are within the Abdomen, seems to be constituted for the sake of this Nerve only, to wit, which lying under the straight Intestine and part of the *Colon*, is inserted into the greatest infolding of the Mesentery.

From the lowest neighbouring Infolding, to which this least owes its original, two Nerves going out, and being sent down into the *Pelvis*, cause there two infoldings, *viz.* one in either side, in which the Nerves coming from the *Os sacrum*, and ingrafted with the former, meet; from which also the Nerves distributed into the adjacent parts, serve unto the several Excretions, *viz.* of the Urine, Dung, and Seed made in that place: for two Nerves enter into the end of the straight Intestine, and as many into the Womb or Prostates; but one, and that a noted one, is carried into the Bladder.

But that we may return to the Intercostal pair, after either Trunk of it had sent forth three branches, out of which the aforesaid lower infoldings of the *Abdomen* are mediately or immediately made, it descends straight towards the *Os sacrum*, and in its journey sends forth yet one or two branches into the Ureters: but as soon as it is come to the beginning of the *Os sacrum*, both nerves mutually inclining themselves to one another, are demerged within the bending of the same bone, and there nigh its declining, and then in its descent, they seem to be knit together upon it by two or three processes; and so at length either nerve ends in very small fibres, which are distributed into the Sphincter of the *Anus*. But sometimes either nerve joyn together into a round infolding nigh one transverse process, out of which single infolding the like very small Fibres are produced. Further, many others from the last Vertebral Nerve meet with, and are ingrafted with these Fibres from the intercostal pair inserted into the *Anus*.

CHAP. XXVI.

The Explication of the Intercostal Pair of Nerves which are described in the former Chapter as to their Offices and Uses: and first the upper Branching of them is considered.

THE beginning of the Intercostal Nerve are two or three shoots reflected or turned back from the Nerves of the fifth and sixth pair, and united into the same Trunk, *Fig. 9. D. a. a. b.* Here we may wonder at the birth of this Nerve, as it were borrowed; for it grows as a shrub upon another tree or shrub; and therefore dispenses the common virtues and influences of either with a double branching, *viz.* both its own and that of its parent: by which ramification or branching it comes to pass, that there are very quick commerces and consent between the conceptions of the Brain and the affections of the *Præcordia*, also between the Actions and Passions almost of all the parts of the whole Body, which belong to the involuntary Function. For in that the Trunk of the intercostal Nerve proceeds from the Nerves of the fifth and sixth pair nigh their beginnings, that is a sign that both the influence of the animal Spirits, and the instincts for the performing of motions, are derived chiefly into it from the Cerebel; to wit, from whose annular process the aforesaid pairs of Nerves arise. But forasmuch as the same intercostal Nerve is rooted in their Trunks, and not immediately in the Cerebel; this is the reason why the Eyes, as also the parts of the Mouth and Face, to which the fifth and sixth pairs have regard, do answer so readily and unknown to the Cerebel, as it were by the same act, to the motions of the *Præcordia* and *Viscera*, which the intercostal Nerve effects; and on the contrary, the motions of these presently follow the action of those. As for example, in Sneezing as soon as the nervous Fibres besmearing the Nostrils, are wrinkled together by the pulling, presently by the passage of the intercostal nerve the Diaphragma, by reason of a more deep inspiration or drawing in the breath, is for some time depressed; then the Cramp of the Nostrils remitting, the Midriff also being violently drawn back, causes a more strong breathing forth with a vehement blowing of the Air. In like manner on the contrary, when by a tickling made upon the Ribs, the Diaphragma being affected with a Spasm, moves to a cackling noise, the Face and Mouth are pathetically figured with it into laughter.

The intercostal Nerve being slid out of the Skull, presently constitutes the Ganglioform infolding, *Fig. 9. G.* it being after the same manner in the Trunk of the wandering pair. What the use of these infoldings is in general, we have already shewn; and clearly for the same reason in this place in the intercostal Trunk, where it receives into it self some nerves from elsewhere, and sends forth others from it self into the neighbouring parts, this infolding, as it were a knot in the stem of a flourishing Tree, is made, that it may be as it were a diverting place for the manifold tendency of the Spirits. As to the adventitious Nerves it is observed, That by them plenty of subsidiary Spirits are transmitted hither, only from the spinal Marrow, but by a manifold and frequent passage; wherefore in this infolding, and again in the

the following, then a little lower, nigh the several junctures of the *Vertebra*, the Vertebral branch comes to either Trunk of the intercostal pair: this seems to be so constituted for many uses. First, That the intercostal Nerve, by the reiterated fastening to the solid parts, as it were by a frequent stay, might become the more firm for the making of a long journey, when otherwise its little rope, by too much stretching out, might be easily broken. Secondly, By this means it comes to pass, that the nerves which are the Executors of the spontaneous, and those of the involuntary Function, might have both a more certain commerce together, and might be sometimes excited into mutual succors. Hence Respiration and some other Acts, especially what concerns the Act of *Venus*, participate of either Regiment, so that sometimes they follow the will, and sometimes draw it even by force or unwilling. Further, when at any time the stock of animal Spirits is deficient in either Province, supplies of them are sought from the other: to wit, (as we hinted above) if the influence towards the *Præcordia* be shut up through the ordinary passages, viz. the internal nerves, their passages requisite for the sustaining of life, might be supplied by the Vertebral branches: yea it is probable in the partial *Apoplexie*, and in the *Incubus* or Night-mare, when the Cerebel being affected, the Spirits destinated for the Heart, suffer an Eclipse in the Fountain it self, that through these Emissaries, to wit, the Vertebral branches inserted into the intercostal pair, some extemporary Subsidies are carried for the actuating the Heart. Thirdly, The Vertebral branches by so frequent an insertion, are added to the intercostal nerve, perchance in some respect for this end also, that the superfluous or excrementitious humidities, heaped together about the spinal Marrow, might be sent away by these Processes: for indeed we have already shewn, that a certain humor doth abound within the Head, the medullar Appendix, and nervous System; which oftentimes (when it becomes watry, or abounds above measure) begets a serous heap in those parts: wherefore when the branches of the intercostal nerve are terminated into the Mesentery, Kidneys, Intestines, and some Genital parts, it is probable they do transfer into these sinks superfluous humidities, not only their own, but also of another sort, to wit, those received from the spinal Nerves.

As to the Nerves, which as Emissaries, are carried from the aforesaid Ganglioform infolding into other parts, we observe; first, that a noted shoot is carried from hence into the Sphincter of the Throat, *Fig. 9. γ*. This nerve in the Sphincter of the Throat corresponds with others akin, arising higher from the fifth pair, and distributed into the parts of the Palate and Mouth, and is helpful to them in the business of chewing: for when the maxillar branches of the fifth pair should perform their work for the chewing of the food taken in, the task of this nerve mediately arising also from the fifth pair, follows, to wit, whereby the Throat being opened, the chewed meats may be thrust forward into its passage.

Another shoot is stretched out from this infolding into a like infolding of the wandering pair placed near, *Fig. 9. α*. The reason of this insertion is delivered above, where we treat of the wandering Pair. But it may be observed further concerning this; when so nigh a communication happens between these infoldings, and when shoots are sent from one of them into the Muscles of the *Larynx*, and from another into the Muscles of the Throat, from hence we may give a reason, why in Hysterick distempers and in some Hypochondriacal there is so frequent and familiar a Symptom of the sense of choaking in the Throat. For a Cramp or Convulsion being begun in any nerve, it is wont to creep forward further by the passage of the same, and so to invade sometimes these parts, sometimes those successively. If therefore at any time a Spasm arises any where in any nerve of the wandering or intercostal pair, and from thence tending upwards or downwards, shall come to either infolding, presently both being affected, and the Muscles of the whole neighbourhood being contracted, a bulk or Tumor like a Globe or round thing in the Throat is excited with a sense of choaking.

The intercostal Nerve descending a little lower, contains in the neck another greater infolding proper to man, to which a noted Vertebral nerve is inserted also, out of which many nerves destinated to the *Præcordia*, are sent forth on either side, *Fig. 9. T*. As to the principal parts, to wit, the Brain and Heart, there is no such great difference between a Man and a Brute, as there is about the passage of one to the other, or the commerce that those parts have mutually among themselves. In either kind, for the exercise of the vital Function, the animal Spirits are derived

from the Head, with a constant emanation into the Heart ; to which sort of influence of theirs the passage of the wandring pair of nerves seems sufficient : wherefore in most Brutes the passage to the Heart and its Appendix lyes open only by this way, and scarce at all by any nerves of the intercostal pair. But in Man the intercostal nerve, besides its offices in the lower Belly, common to him with other Animals, serves in the place of a special Internuncius also before the Cloister of the Breast, which bears the mutual senses of the Brain and Heart this way and that way, or to and fro. For when, besides the nerves of the wandring pair, stretched out also into the humane *Præcordia*, (which certainly seem sufficient for the executing of the offices of the Function merely vital) so many noted branches are sent forth from the aforesaid intercostal infolding, what kind of office should be attributed to these, unless that they should contain the animal Spirits, by whose work and ministry the mutual respects and affections of the Brain and Heart should be communicated to one another? Whilst I consider this difference of either kind, it comes into my mind, that Brutes are like Machines framed with a more simple furniture and with less workmanship, and therefore furnished with a motion of one kind only, or determined for the doing still the same thing. But in Man divers series of motions, and as it were complications of wheels within wheels, appear. For indeed, by the passage of the aforesaid infolding, the conceptions of the Brain presently affect the Heart and its Vessels, and cause the rest of the Appendix, together with the Diaphragma, to be moved. Hence the motion of the blood and its inkindling in the Heart, together with the Pulse and Respiration, are altered : and for that cause, from the Heart being altered, not only impressions are retorted upon the Brain by the passage of the same nerves, but also the blood it self, its course being changed, drives to the Brain with a different or unaccustomed fluctuation, and so by moving the animal Spirits with various impulses, causes first one sort of conceptions, and then others to be produced : and so by reason of these reciprocal affections of the Heart and Brain, which are wont by a long series to be propagated vicissively, a multiplicity of thoughts and Phantasms arises. Hence both the ancient Divines and Philosophers placed wisdom in the Heart. Certainly the Works of Prudence and Vertue depend very much on the mutual commerce which happens to the Heart with the Brain : because, that cogitations about the acts of the Appetite or Judgment may be rightly described, it is behoveful for the flood of the blood to be restrained in the Breast, and the inordinations of it and of the Heart it self to be governed by the Nerves, as it were by Reins, and to be composed into requisite and apt motions. We might say more concerning this, but that this Speculation is from our purpose, and belongs more properly to Pathology or the Doctrine of the Passions of the Soul. In the mean time, we may refer hither one or two Observations taken from *Anatomy*.

When of late we had dissected the Carcass of a man that was a Fool from his birth, we could find no defect or fault in the Brain, unless that its substance or bulk was very small. But the chief note of difference which we observed between the parts of this man and of a man of judgment, was this, That the aforesaid infolding of the intercostal Nerve, which we call the *Internuncius* of the Brain and Heart, proper to man, was very small in this Fool, and beset with a weaker guard of Nerves.

Whilst we were writing these, we made an Anatomy of a Monkey, whose Brain differed little from that which is seen in a Dog or a Fox, unless that it was much more capacious in the proportion to the bulk of his Body, and the turnings and windings of it were larger. The orbicular Prominences called *Nates* and *Testes*, also the ringy Protuberance, sent down from the Cerebel, came nearer the figure and magnitude of those parts in a man. But what occurred chiefly worthy noting, was this, viz. That the intercostal Nerve, although even as it is wont to be in other Brutes, being included in the same sheath with the Trunk of the eighth pair, was carried through the Neck, yet departing from this Nerve near the Chancel-bone, before it was inserted into the infolding, placed nigh the roots of the upper Ribs, did send forth some shoots into the Heart and its Appendix, and certain Fibres into the nerve of the Diaphragma : which perhaps partly is the reason, why this Animal is so crafty and mimical above other Beasts, and can so aptly shew and imitate, not only the gestures, but the passions and some manners of a Man. But we will proceed to the explication of the intercostal Nerve from whence we have digressed.

We have already intimated for what use the Vertebral branch is inserted into its cervical infolding. There is the same reason for this as for the other Vertebrales, which

which communicate with the intercostal Nerve almost in its whole passage. But for that the nerve of the *Diaphragma* is radicated in the same Vertebral nerve, from whence a branch comes into this infolding, I say from that a reason may be taken, why the motion of the *Diaphragma* intimately conspires with the *Præcordia*, yea and with the conceptions of the Brain: which kind of Sympathy of the *Diaphragma* with the other parts, because it is requisite to be more strict and noted in man, it is observed, That not only the Vertebral branch cometh between the infolding and the root of the nerve of the *Diaphragma*, but two and sometimes three nerves are sent from this infolding into the trunk it self of the nerve of the *Diaphragma*, Fig. 9. §. §. Truly from hence not only the joynt action or *Sympraxis* of the *Diaphragma* with the *Præcordia* may be derived; but also the genuine cause is here manifest, why Risibility is a proper Affection of a man. For as often as the Imagination is affected by any pleasant or wonderful conception, presently the Heart desires to rejoyce, and as it were by shaking off its load to be eased: wherefore that the blood might be more swiftly emptied out of its right bosom into the Lungs, and consequently out of the left into the *Aorta*, the *Diaphragma*, instigated by the passage of the nerves going out of this infolding, is drawn upward by a more rapid *Systole*, and raises up the Lungs, as it were making iterated leaps, and causes them, by their more frequent striking together, to drive out both the Air and the blood. Then forasmuch as the same intercostal Nerve, which communicates lower with the nerve of the *Diaphragma*, is continued also higher with the maxillary Nerves, a cackling being made in the Breast, with it the gesture of the Mouth and Face pathetically answers.

One or two noted shoots and many nervous Fibres are carried from this infolding into the returning Nerve, Fig. 9. §. Certainly the reason of this communication seems to be, that the *Diaphragma* and the Heart it self (into which nerves are sent from this infolding) might yet more conspire with the rough Artery (which the returning nerve affects) in its various actions, and especially in laughing, weeping, and singing. Moreover, when the returning Nerves, by pulling upwards the Trunks of the *Aorta*, cause the blood, for the stirring up some Affections, to creep more swiftly towards the Head, they may in the performing that office be much helped by the associate labour of the Nerves sent from this infolding.

From this infolding in the Neck many small fibres and shoots are spread into the sanguiferous Vessels, as also into the Coats of the *Trachea* and the *Oesophagus*, Fig. 9. *ibid.* As to what belongs to the former that respect the *Trachea* and the blood-carrying Vessels; their office is, that they may respectively draw together and spread abroad those chanel of inspired and expired blood and Air, according to the way and manner wherewith the Pulse and Breathing ought to be performed; whereby the motions of either might be the better retarded or accelerated, according to the necessities or requirings of the Heart. Then numerous Fibres are stretched out from this infolding into the Coats of the *Oesophagus* placed near, that by this means the admirable consent between the Heart and the Stomach, by reason of the Nerves being reached forth from this infolding and from the wandring pair to both, may be produced.

Concerning the Cardiack branches sent from this infolding, we need not discourse any more: after having but now intimated, that these were as it were *Internuncii* peculiar to men, which carrying to and fro the reciprocal impressions of the Brain and Heart, cause Commerces in both Kingdoms. But forasmuch as Nerves of a double kind, *viz.* of the wandring and intercostal pair, respect the humane *Præcordia*, lest the gestures of one should be different from those of the other, therefore the *Cardiack* branches, which are of either family, partly communicate in the same infolding, and are partly inoculated mutually by shoots sent forth before they are distributed into the Heart it self.

Below the Cervical infolding, the intercostal Trunk being demersed within the *Thorax*, admits three Vertebral Nerves arising higher, and constitutes the other infolding, which is commonly called the Intercostal, but more properly the *Thoracical* infolding, Fig. 9. ©. In this place the intercostal Nerve being about to pass into its last and more large Province, *viz.* the *Viscera* of the lower Belly, and therefore seeking aid for the journey, and as it were a *Viaticum* for it self, it gets together in this infolding an increase or aiding forces from the Vertebral nerves, and afterwards receives lower others fresh nigh the several knots of the *Vertebrae*; because it will have need of a great stock of Spirits, which it must bestow on the Mesenterick infoldings, and on other parts of the *Abdomen*. That

That this Nerve about to enter the Thoracical infolding, doth bind the Chancel-bone Artery, *Fig. 9. l.* and that the superior branch of the Vertebral, being sent into the same infolding, doth bind about the Vertebral Artery, *Fig. 9. π.* the reason of both seems, that the blood, for the uses and necessities of the lower *Viscera* (to which the intercostal Nerve from thence serves) may be driven forward with a more plentiful afflux downwards: which thing those Nerves easily do by pulling together the blood-carrying Vessels towards their infolding; so that they attempt this snatching of the blood in opposition to that which the returning Nerves perform. And indeed when the blood, tending upwards and downwards, is wont sometimes to flow too much towards either bound, sometimes to be wanting; therefore the nerves, as it were an incitement or remora, are variously disposed both in the upper and lower region of the Circuit about the sanguiferous Vessels. After what manner this Thoracical infolding is in brute Beasts, shall be particularly shewn hereafter. The intercostal Nerve in a Man, both in this infolding and in the whole descent through the *Thorax*, receives many Vertebral nerves, as if sparing of its own stock, and greedy of anothers, but sends forth from it self not a shoot: whatever of Spirits is remaining either from the influence above, or comes to it by the by, is reserved wholly for a largess to be bestowed on the *Viscera* of the lower Belly. But after what manner, and by what passages of nerves that is dispensed into the several parts, we will unfold in the following Chapter.

C H A P. XXVII.

The lower Branching of the Intercostal Nerve belonging to the Parts and Viscera of the lower Belly is unfolded.

After the intercostal Pair hath past through the hollowness of the *Thorax* without any expence of Spirits, unless in the Neck-infolding, at length it sends down from the region of the Ventricle on both sides, a noted Branch; either of which presently becoming divided into two, constitute two peculiar Infoldings on either side; but one infolding arises in the midst of them, as if common to either side. Of the infoldings which are on the left side, one respects the Kidney, and the other the Ventricle with the Spleen; but of those which are on the opposite side, one respects the right Kidney, and the other the Liver and its neighbouring part. In the midst of these, the infolding proper to the *Mesentery* and the biggest, is placed as the Sun among the other *Planets*. Further, from these are sent forth one to another and into the neighbouring parts numerous Fibres very thickly, as it were dartings of rays. *Fig. 11.* plainly shews all these.

Concerning these, in the first place, it shall be inquired into in general, For what end so many nervous infoldings, with almost innumerable fibres and shoots, are distributed about the *Mesentery* and the *Viscera* of the *Abdomen*. For when in these parts the fibres and nervous shoots are carried on every side with so thick a series, that they are variously infolded with their manifold meeting, it may seem wonderful, if every one of these be destined to some uses, and are not rather sprinkled here and there by chance, and as it were by the inconsiderate sporting of Nature. And indeed any one can scarce think, that so many Vessels should be prepared for the performing the offices of motion or sense in that place. For those *Viscera*, unless highly pulled and affected with a Convulsion, are sensible of little or nothing that we know of; and their motions are almost no other thing than obscure Vermiculations or light Corrugations, so that for the effecting them there is required no greater preparation than for the slow progress of a Snail. Wherefore from hence it hath come into the mind of some, that a certain Juyce, and that perhaps nutritious, was dispensed by this manifold passage of the nervous Pipes: which sort of office however if assigned to these Fibres dispersed about the *Mesentery*, why should not the same office either of receiving or of carrying of nourishment, be granted to those in like manner divaricated about the Lungs and the *Præcordia*, and especially about the rough *Artery*? But truly it

it is highly improbable, that a nutritious Juyce should be contained in the Coats of the *Trachea* or of the *Bronchia*, which the nerves may suck out; nor does it more clearly appear, why more nerves should be destinated for the carrying of the alible Juyce to these parts of the Abdomen, or those of the Breast, than is needful for the musculous stock. But in the mean time, though we deny, that the whole nutritious matter is carried this way and that way by those or the other nerves; yet we think, that within those nervous passages an humor doth perpetually abound, which may be for a Vehicle of the animal Spirits, and a Ferment for the nutritious matter: with which going with the nervous humor towards the Intestines and to the other sinks of the Body, it is likely, that the superfluous and excrementitious serosities do often slide down together, and so are carried out.

But it may be well thought, as to the Mesenterick Nerves, and Infoldings in which they are terminated, and the Fibres most thickly going out of these, that these different manner of Vessels are first Channells, then Storehouses, and lastly the last Emissaries of the animal Spirits. If it should be demanded, for what end so great plenty of Spirits should be designed for these ignobler parts; I say, that this is done for the performing the acts of Motion and Sense there, which are highly necessary for the preserving of life it self. For although local motion, which is always performed by the help of a Muscle, as of a Spring, is not convenient for the *Viscera* of the lower Belly; yet intestine motions are brought forth by them almost continually, and after many fashions: viz. for the subduing the Chyle, also for the separation of some parts and particles from others, both of that, and also of the bloody Liquor, and the protrusion of every one towards their designed bounds, the Fibres and nervous shoots reaching into the Membranes of the *Viscera* and the Coats of the Vessels, yea and into the textures of the *Parenchyma*, are variously drawn together, to wit, these are pulled upwards, those downwards; sometimes many together, sometimes apart or successively, are wont to be drawn thither and thither. In truth, it is a sign of the indiscontinued action of these *Viscera*, that as well in sleep, and perhaps more than in waking, the Culinary work of Nutrition is performed; and whilst the Organs of the other Faculties are at rest, there is no quiet granted to these: but that the Mesenterick nerves perpetually grinding in the Mill, are always busied for the preparing the alible humor and the exporting the same towards all parts.

Moreover in these parts, to which the aforesaid Nerves belong, there is found an exquisite feeling no less than a motive Faculty; for whatsoever heterogeneous or hurtful thing, mixed with the Chyle or blood, is brought to any *Viscera*, presently the Spirits, inhabiting those parts, being warned of the evil, do greatly tumultuate as it were by entering into a Conspiracy, that what is hostile or troublesom they might shut out. But indeed, because the animal Spirits, flowing by the passage of the intercostal nerve to the Intestines and *Viscera* akin to them, proceed from the Cerebel; therefore the businesses of either Faculty, to wit, both the sensitive and locomotive, forasmuch as they are performed the Brain unconsulted, and the animal scarce knowing it, are not so openly taken notice of, and for that reason they are accounted of less than the spontaneous acts of the other parts.

But as to the manner it self or way of the œconomy, whereby the animal Spirits, destinated to the *Viscera* of the lower Belly, are exercised, we affirm, That plenty of them flow into all the Mesenterick infoldings by the passage of the nerves sent from the intercostal pair; where being heaped up to a fulness, as it were in so many Storehouses or places of Receipt, they are kept to be distributed from thence into several parts, as occasion requires. But that the Spirits flow out of these infoldings, not through singular and larger branches, (as is done in the Muscles) but as it were by Troops of Fibres, into their proper tasks, the reason is, because here the business is performed otherwise than in the musculous stock. For where a Muscle is fixed to the part to be moved, its implanted Fibres perform the whole work of Contraction, or of the motive endeavour; but it suffices for the nerve still to convey new supplements of Spirits, and as occasion serves, the Instincts of the Motion to be performed: but in the Membranes and the *Viscera*, where Muscles are wanting, the nervous Fibres themselves most thickly implanted, and distributed as it were so many little ropes, almost into every part of the subject, perform the business of Traction or drawing by themselves and their own proper endeavour or force partly; and partly sollicit or stir up into motion the Fibres implanted in the *Viscera* disposed after an uncertain order; which they determinate in their action, and moderate or govern them,

them, as it were so many fingers laid upon the strings of a musical Instrument. For although the Membranes and the *Viscera* themselves are indued with some implanted Fibres; yet these are not, as it is in the Muscles, of one kind and position; but in the same part some are straight, and others oblique or crooked, these tend upwards, those downwards, and others are carried round; so that divers sorts of motions ought to be performed in the same Membrane or Inward, sometimes together, sometimes successively or by turns: wherefore distinct nerves are required, not only for the several series of Fibres, but for all the parts of the subject, to wit, which may stop here a motion begun in that place, and may begin another anew, or may unite one with another. Truly the motion which is performed in the musculous stock seems like the rude and more simple work of some Weaver, where the shuttle being always cast after the same manner, the Woof is laid under the Thread or Yarn: but the motions of the Intestines and *Viscera* may be aptly compared to a Texture very much variegated or flourished, for the weaving of whose more artificial substance or making there is made use of many hands together, or of a Machine diversly turning about, and furnished with more than a thousand sorts of motions.

Concerning the many Mesenterick Nerves, and Shoots, and nervous Fibres which go out of them by bands, we must consider chiefly these two things: to wit, what may be the office of each of them for the stirring up of motion or sense, either of them, or both together in any part: then secondly, what the communication of either of them may be with other nerves, infoldings or bundles of nerves, by reason of which a Sympathy or consent of actions arises at once in divers parts. According to these two respects we will particularly weigh now the several nervous Vessels belonging to the *Viscera* of the lower Belly.

Therefore in the left side the supreme Mesenterick branch being presently forked like the figure of the Letter Y, contains in its upper shoot the Stomachical infolding, which is also the Splenetick, and in the other lower the Renal infolding or that belonging to the Reins. Moreover, about the knot of division it sends forth some shoots to the greatest infolding of the Mesentery, *Fig. 11. F. G.* Hence a reason is plain, wherefore there happens such affinity between the Ventricle and the Spleen, and between the Mesentery and the Reins, so that the very often and familiar Symptom of Vomiting is both in Splenetick, Colical, and Nephritick people: because when a Convulsion is begun in any part or Inward, which the Mesenterick nerve respects, presently other parts, to which the infoldings or shoots of the same nerve belong, are drawn into consent.

From this lower infolding a little bundle of Nerves being carried towards the Stomach, inserts its Fibres partly in its bottom, and partly sends them to meet with other Fibres sent down from the nerve of the Stomach, *Fig. 11. n.* The reason of the former is, That whereas there are many Coats of the Ventricle, and divers series of Fibres are disposed in them, for the actuating all of which with a due influx of animal Spirits, the Stomachical nerves, derived from the wandring pair, are not sufficient; it was fit, that for the outward Court as it were or Precinct of this Inward, to wit, for the outmost bottom of it, some forces of Spirits might be supplied from some strange Kingdom, to wit, from the aforesaid nervous infolding of the Abdomen. Instead of this, Spirits also may slide downwards from the same Stomachical branch through other Fibres sent down, and be sent into this Splenetick infolding. Besides also it is observed, That the adventitious nerves aptly conspire with the former, being of the proper dominion of the Ventricle, and that either are not only inoculated within the confines of the Inward it self, but they run into mutual embraces without it, and as it were joyn hands together.

It seems plain, that the nervous Filaments being carried from the aforesaid infolding to the bottom of the Ventricle, may serve there for the performing the acts of Motion and Sensation: but it doth not so easily appear with what office the other handful of Fibres reaching out from hence into the Spleen is charged (*Fig. 11. ζ.*) because this Inward is said to be destitute wholly of every animal Faculty. When we did elsewhere inquire into the use of the Spleen, we thought good to affirm, That its office was to separate the dregs of the Blood and the acid-saline Particles, and whatsoever were of a more fixed nature, and to concoct them more being received into its own bosom, and to convert them into an acid Ferment; by which being again delivered to the blood through the Veins, a sharpness and an asperity, as also an active or fermentative virtue are gotten for its *Latex*. Wherefore the whole substance

Itance of the Spleen consists of a texture of Fibres in the form of a net; to wit, that the Feculencies of the blood might be more plentifully received, and contained within its spongy cavities and thick passages. I say therefore, that for the fit preserving and dispensing of the Splenetick Ferment, besides the Arteries which carry matter, and the Veins which continually sup back some portion of the same fermented, there seems to be need of many nerves also, which both by pulling the fibrous texture of the Spleen, might cause the melancholick and dark *Fæces*, laid up in it, to be shaken together, and so by defending it from putrefaction and coagulation, cause it to be imbued with an acid and fermentative nature; and also that those nerves may sometimes draw together and constrain the blood-carrying Vessels, sometimes open and enlarge them; that as occasion serves, the Feculencies of the blood may be sometimes more plentifully, sometimes more sparingly laid aside out of the Arteries into the Spleen; also that more or less of the Ferment, preserved in the Spleen, may be poured out on the blood according to the requirings of the Passions or of the natural Instinct. No Hypochondriack but doth abundantly perceive, that some Splenetick nerves do perform motions; for those great perturbations which are wont to be excited in the left side, as when sometimes Inflations, sometimes constrictions of the inward parts, and sometimes various concussions are perceived with a wandring pain running here and there, they are only Spasms or Convulsions or wrinklins together, with which the nerves of the Spleen are ordinarily affected. Nor do its nerves, taken with a Convulsion, stir up tumults only in the neighbourhood of the Spleen, but oftentimes further into the Heart it self, yea into the whole Body the effects of their inordinations are carried. I have known an Hypochondriack, who presently upon the Spleen being disturbed, seemed to have his *Præcordia*, being drawn downwards, to be cruelly prest and bound together; so that being very sad and dejected in his mind, also complaining of an exceeding great straitness and constriction of his Breast, he thought himself almost dead. The cause of which kind of distemper was without doubt, that when many Fibres going out of the Splenetick infolding are united with other Fibres sent from the farthest end of the wandring pair, it easily happens, that the former, being distempered with the Convulsion, do draw together and pull downwards their yoke-fellows, and by consequence the Trunk it self of the wandring pair, from which the nerves are sent into the *Præcordia*: certainly by the *Sympraxis* or joynt action of either kind of the aforesaid nerves, viz. whereof these respect the Spleen, those the *Præcordia*, it is effected, that the Trembling, Oppression, and other grievous Distempers of the Heart, as also of the Spleen, so ordinarily happen. Further, forasmuch as the Fermentation of the blood depends on the Spleen, according to the influence of this, that performs its Circulation, sometimes pleasantly, sometimes disturbedly. Whilst the Spleen is at quiet, and free from any perturbation, the blood also is quietly moved in Hypochondriacal persons; but if the same be moved and exercised, (as it is wont to be in any passion or violent motion of the Body, or by a Medicine) presently its nerves being distempered with a Convulsion, shake it more with reiterated contractions; so that the fermentative Feculencies, being shaken out of its bosom, flow back more plentifully into the blood, which cause its *Latex* presently to be troubled, and as it were muddy, and sharpen it with so great acrimony and mordacity, that it burns and pricks the Brain and Heart like needles; from whence in Splenetick people, besides that the Reason is obscured, the affections of the Mind, especially Sadness, Hatred, and Anger are very much increased.

Concerning the Splenetick Nerves, by another conjecture, we are yet brought to believe, that they, besides the exercise of the motive Faculty, do both instil into the Spleen its own humor, which promotes the fermentative virtue of that Inward; and also (because the nerves, as was shewn already, convey the Spirits, and sometimes the humors by either way, viz. forward and backward) the same implanted in the Spleen, do often imbibe from it an acetous or Vinegar-like humor, and as it were Vitriolick, from whose acrimony and notable twitching, they are forced into Convulsions.

But forasmuch as the nervous Infolding respecting the Spleen, communicates more nearly with the Ventricle, Mesentery, Liver, and Kidneys, and more remotely with the *Præcordia* and other parts placed at a distance; from hence the cause is plain, wherefore not only these several *Viscera* and parts, by reason of the fault of the Spleen, are folded together; but also on the contrary, why the Spleen being indisposed by any Disease, or trouble raised up in any of those parts, is wont to be disturbed: so it is

not altogether for nothing, that the Symptoms every where infesting, the cause of them being unknown, are ascribed ordinarily to the Spleen; because it fixes not only its own inordinations in other parts, but also suffers for their peculiar faults: which notwithstanding is wrongfully ascribed to Vapours transmitted from this or that part, when the formal reason of every Distemper of this kind for the most part consists in the communication made through the Nerves.

The lower Infolding of the left side seems to be made for the Kidney placed near, into which chiefly the bundle of its Fibres is carried, *Fig. 11. 4. γ. γ.* Certainly that these nerves, following the emulgent Vessels, do embrace the same, and bind them about with a various and frequent complication; that is so made for that end, that by reason of the Artery being so strained and frequently shaken by the drawings of the nerves, the Serum may the more easily be precipitated from the blood: wherefore it is observed in very great difficulty or danger, when the mind and all the nerves are strained for fear, that a frequent and more plentiful making of water, and that often painful, is wont to be provoked.

The Renal Infolding receives, besides the Nerve common to it with the upper infolding, another new and peculiar one from the intercostal nerve, or rather that coming between from the spinal Marrow, *Fig. 11. β.* Hence it is, that the Loyns have a great consent with the Reins, and suffer so ordinarily for their Distempers with a grievous and largely diffusive pain. Forasmuch as this infolding communicates with the greatest of the Mesentery, the Colick distemper and the Nephritick are much akin, and it is often difficult to distinguish their fits one from the other.

The Mesenterick branch in the right side, as well as the left, being forked, contains two infoldings: the upper of these (which we call the Hepatick) sends forth from it self many little bundles of nervous Fibres; the greatest of which being carried towards the Liver, cloaths the Hepatick Artery as it were with a Net made of Fibres, *Fig. 11. δ. ο.* The most Learned *Glisson* observes, That the Hepatick Artery is bestowed on the Trunks of the Vessels, to wit, of the common Chest, of the biliary Pore, and of the *Vena Porta*; for the watering of which, and for the actuating them with heat and nourishing Juyce, it carries the arterious Blood; to which notwithstanding for the recarrying, an associate Vein is wholly wanting: wherefore that ought to carry the blood, not with a full and free influx, but by little and little, and always in a constant measure to those membranaceous parts: for otherwise there had been danger, lest from the bloody *Latex* plentifully rushing forward, for that it could not be still remanded presently through the Veins, an Inflammation should be excited, or lest from its torrent being transfused beyond its banks, the courses of the other rivers in the Liver should be disturbed. But for that the nerves, like Reins, do bind about the Trunk of the Artery, the inflowing of the blood it self is moderated, and they cause it variously to be dispensed according to the wants of those parts to which it is destinated.

From the Troop of Nerves going out towards the Liver, some bend down into the *Pancreas*, and others into the *Cholidock* Vessels, *Duodenum*, and *Pylorus*, and sow into them thick series of shoots, *Fig. 11. π. π.* The office of these seems to be, to pull together the excretory passages of those parts, and to shake them for the causing Evacuations of the boiling or turgid humors upon occasion. Further, from these Fibres being carried upwards, when many others sent from either Stomachical nerve are united, the reason is plain, why from an hawling or pulling made about the Ventricle, the yellow Bile is drawn out of the Gall-chest into the *Duodenum*, which being carried from thence into the Ventricle, by reason of a Convulsion of that same Intestine, is cast up by Vomit: because the Stomachical nerves being irritated by a Medicine, or by any troublesome thing, for the making an Evacuation above, and for that cause drawn from thence upwards, they draw together the nerves belonging to the Liver and the *Cholidock* Vessels, for that they are tied to them, and bring them into consent with the superior Spasm or Convulsion. Hence it happens, that not only the Stomach being first tired, draws to it self the Bile by its Convulsion, and allures it into its own bosom; but the Bile also of its own accord growing turgid, and so being poured out into the *Duodenum*, forasmuch as it irritates the nerves of this Intestine, and then by their consent, provokes the nervous Vessels of the Ventricle, it presently induces a cholerick Vomiting.

The Hepatick Infolding communicates with the Splenetick by Fibres going between either, *Fig. 11. θ.* The reason of which seems to be, That when one infolding respects

spects the end or the right extremity of the Ventricle, and another the left; that a consent in either and a joynt action may be made towards the Stomach, both communicate between themselves by nerves, as if *Internuntii*. Truly it seems to come to pass by the passage of these nerves, that the *Hypochondriacal* pains oftentimes run from the left side into the right; to wit, for that a Spasm or Convulsion begun in the Splenetick infolding, is wont to be carried to the Hepatick.

Between the *Hepatick* Infolding and the greatest of the *Mesentery*, many Fibres reaching out by bands, are cast out in the midst, *Fig. 11. p. p.* the office of which is to sustain a certain commerce and Sympathy; to wit, such an one is required, both that the Chyle may be ministred from the Intestines towards the Liver still in due proportion, also that the Bile may opportunely slide out from the Gall-bladder into the Intestines for the provoking of Excretion. For we are of this Opinion, That the *Meseraick* Veins sucking out a certain portion of the Chyle from the Intestines, immediately transfer it through the region of the Liver into the *Vena Cava*, whereby the blood in the ascending Trunk of the hollow Vein or *Vena Cava*, might be freshly imbued with nourishing Juyce; even as in its descending Trunk it is refreshed, the same being poured out through the *Thoracical* Vessels or those belonging to the *Thorax*. Wherefore it is needful, that there should be a very strict affinity between these *Viscera*; and the rather, because the Bile ought to be poured out from the Gall-chest to the Intestines, not continually, but for some uses, by occasions and intervals. For the Nerves knowing best the wants of either part, warn them both of their mutual duty, and as occasion serves, stir them into action.

It is observed, That in the right side an ample Nerve is stretched out between the *Hepatick* and *Renal* infolding, *Fig. 11. μ.* So that between these infoldings a greater and more immediate consent is had, than between those pairs of the other side. The reason of which doth not easily appear, unless perhaps it should be so made for this end, that when from the Reins, in making of water, there is an endeavour of the ferous Excretion, the *Pylorus* and the *Cholidock* Vessels being at once drawn downwards, a protrusion of the Chyle and *Fæces* might be provoked towards the lower parts of the Belly. Certainly this connexion of these infoldings is chiefly the cause, why oftentimes most cruel Vomiting uses to come upon a Fit of the Stone; and that from such a Vomiting the *Cholidock* Vessels are very much emptied, as if provoked by taking an Emetick.

The greatest Infolding of the *Mesentery* being placed in the midst of the rest, like the Sun, disperses every where round about nervous Fibres like rays, *Fig. 11. ⊙.* and casts them not only on every one of those infoldings, as if so many Planets with a peculiar Aspect, or *Actinobolism* or Irradiation, but also it distributes them into many Intestines, sanguiferous Vessels, and other parts lying round about: without doubt upon these nervous Filaments, which are carried from this infolding to the Intestines, as Lines from the Centre to the Circumference, every action of the Intestines, and especially the Peristaltick motion of the Vermiculation, depends; namely for that these Fibres do move successively, and still move further every begun action, as it were with a spiral or Screw-like progrrels.

That from this Infolding many Fibres and shoots going forth, are inserted into the Trunk of the *Aorta* nigh its descending, and that these reaching towards the Intestines, accompany the Blood-carrying Vessels, and in several places climb over them; from hence it may be inferred, That nerves also in the Abdomen are like Bridles and Reins cast on the sanguiferous Vessels, which either by straining or pulling them together, may sometimes retard, sometimes incite the course of the blood according to the needs of the lower *Viscera*.

From the greatest Infolding of the *Mesentery* some noted Fibres and shoots are sent out into the *Glandula's* of the Womb or the Womens Testicles, *Fig. 11. τ. τ.* Into which also other shoots from the Trunk of the intercostal Nerve, *ibid. υ. υ.* and others going out of the nerve which comes between this infolding and the lowest of the Abdomen, do come together, *ibid. ϕ. ϕ.* So that a provision of Spirits is carried into those parts from a threefold Store-house; which indeed is much larger than is done in the other Sex, when we find scarce any nerve to belong to mens Testicles. Indeed the Womb, besides that it is a very sensible part, ought also to be moved diversly, and in bringing forth a child very strongly: wherefore there are granted to this both more strong implanted Fibres, and also Nerves of a various kind and original.

Most of the Infoldings of the Abdomen, but especially the lowest, and that re-

lated to it the greatest of the Mesentery, are oftentimes affected in the Passions commonly called Hysterical, as shall be presently declared. Therefore if at any time such distempers proceed from the Womb, the cause is manifest wherefore the aforesaid infoldings are drawn into consent. But we have elsewhere shewn, That those Passions are merely convulsive, and not seldom excited without any fault in the Womb. Further, that Symptom very frequent in those kind of Fits, to wit, in which as it were a Globe is perceived to be carried from the bottom of the Belly, and about the Navel to leap out impetuously, which therefore is thought to be an ascent of the Womb; I say, that it is nothing else than most cruel Convulsions of these infoldings. Indeed oftentimes in Women, and sometimes also in Men, I have known when the convulsive Affection hath invaded, that a bulk in the *Hypogastrium* hath been seen to arise, then about the midst of the *Abdomen* so great a swelling to follow, that it could not be hindred or prest down, though strongly attempted by the hands of a strong man. Without doubt, the cause of this admirable distemper is, that within the nerves of the intercostal pair the inflowing animal Spirits, as often as they begin disorders or convulsive motions, first (as it is wont to be) begin to grow hot or to be exploded about the extremities of the nerve, to wit, in the lowest infolding of the *Abdomen*; which affection of theirs, when creeping upwards it is carried to the greatest infolding of the Mesentery, so that the Spirits inhabiting it are taken with the like inordination, it is no wonder, if that swelling up of the middle of the *Abdomen*, and as it were an explosion of a certain nitrosulphureous matter, should be stirred up. For truly it is not probable, that that Symptom should be excited from the Womb ascending and being removed from its place, because, besides this part being fixed in its place and firmly established with Ligaments, the bulk of it also in Virgins is so small, scarce exceeding the bigness of a Walnut, that although it should be carried up into the Belly, it could not produce such a swelling. Nor is it more likely, that this sort of distemper is stirred up from the Muscles of the *Abdomen* taken with a Convulsion: for they, however convulsive, draw together themselves and subjected parts upwards or downwards, or of one side, but they are not able by any means to bear themselves aloft, and to lift up on high, with a force, the region of the Navel. But, as we suppose, the animal Spirits in the greatest infolding of the Mesentery growing fierce, and becoming apt to be exploded, (as such indeed they are whenever they enter into convulsive motions) they being there gathered round thickly into a Globe, do mainly blow up and lift on high with their effervescency and notable rarefaction that infolding with its whole neighbourhood, and at once drive upward the *Viscera* lying upon it with a certain vibration or shaking. A more full explication of this Symptom belongs to the Pathology of the Brain and Nerves.

In the mean time we shall take notice, that another certain Distemper, viz. the Colical grief doth belong to the infoldings of the *Abdomen*, and especially to this greatest of the Mesentery. For it may be thought, that the most cruel torments that are wont to be excited in this disease do come, not from an excrementitious matter shut up in the cavities of the Intestines, nor always from a sharp humor impacted in their Coats, but oftner from the nervous Juyce imbued with a certain acrimony, and stagnating within this infolding; from whence, by reason of a consent of this with the infoldings both Hepatick and Splenetick, a frequent and cruel Vomiting comes upon these pains. But these *Pathologic* Speculations being referred to their places, we will follow what we first of all instituted, the further passage of the intercostal Nerve, by which we are led to the two lesser and lowest Infoldings of the *Abdomen*.

Below the Mesenterick Nerves, out of which the superior Infoldings are made, either descending intercostal Trunk sends forth three or four singular shoots, which are carried into the Ureters, *Fig. 11. v. v.* The use of these seems to be, to pull together, and to jog or shake those urinary Channels, that the Serum separated in the Reins, may be the more readily drawn out towards the Bladder. Moreover, if at any time a viscous or muddy matter doth stick to the passages of the Ureters, or a more fixed stone doth obstruct their Cavities, they, by the help of the Nerves inserted here and there in their whole tract, being pulled together and wrinkled, may prest down and always move forward any bulk or substance staying in the passage.

Nigh the *Vertebrae*, out of which the Crural Nerves begin to go forward, three distinct branches brought to either intercostal Nerve, are carried from thence into the lowest hollowness of the Belly, where they make the infolding which is the lowest of the *Abdomen*, *Fig. 11. D. p. p. p.* That here so many nerves, to wit, six large ones joyning

joyning together do make but a small infolding, *viz.* a lesser than is raised higher in a single branch of the nerve; the reason is, because this infolding is like an Inn, where the inflowing Spirits dwell no long time, but it receiving them only in their passage, presently commits them to other infoldings placed here and there above, below, and of one side, and made for divers offices; for from hence the chief passage, and as it were a broad way, leads to the greatest infolding of the Mesentery; moreover, from hence nerves, diversly going out, make three other infoldings, which respect the parts and ways by which the several Excretions, to wit, of the Dung, Urine, and Seed, are made in the lower Belly.

The first Nerve therefore sent out of this lowest Infolding into the greatest of the Mesentery, a little before it reaches to it, imparts two noted shoots to the Glandula's of the Womb; but in its ascent it admits four other branches, as it were subsidiary, *viz.* two on either side from the intercostal pair, *Fig. 11. x.* so that the nerve here seems to be the chief means of passage of the animal Spirits destined to the greatest infolding of the Mesentery and to the uterine Glandula's; which passage however is carried into the designed parts, not immediately, but a compass being made, it first goes forward beyond its bound, and at length with a certain going back. The reason of which is, that the motions of all the Intestines, *viz.* the Vermiculations should be directed downwards towards the straight Intestine, and also that the actions of the Womb should tend thither; therefore 'twas fit, that the animal Spirits should be supplied from below whither the motion inclined. For by the like means, this Mesenterick nerve and the two returning nerves, being first carried lower, ascend into their Provinces; to wit, that they may pull together the respective parts toward that bound placed below, as it were to a Pully.

Further, for this end, to wit, that the influence of the Spirits actuating some Intestines, might be derived lower; the other infolding of the Abdomen, to wit, the least, is added immediately to this. Because upon the Nerves being carried from hence about an inch, there grows a small infolding; out of which, one nerve being sent out into the greatest infolding of the Mesentery, stretches it self under the top of the straight Intestine and part of the Colon, *Fig. 11. y. a.* And another nerve, descending from this infolding, is carried under the lowest part of the same straight Intestine, *Fig. 11. b.* which also, two shoots carried from the infoldings placed in the Pelvis or Bason, meet, *Fig. 11. d. d.* It will not be hard to declare the uses of this infolding and its nerves: because all those nervous passages are emptied about the offices and motions of the straight Intestine. The ascending nerve directs the Vermiculations of the same straight Intestine, as also of the lower part of the Colon, and then (the greatest infolding of the Mesentery mediating) of some other Intestines to be made downwards; but the descending nerve, in opposition to the other, drawing the lowest part of the straight Intestine upwards, takes care that the Excrements being carried towards the Arse-hole, may not slide out suddenly and unexpectedly. Then forasmuch as two nerves from the two infoldings placed within the Bason or Tunnel, (which infoldings immediately admitting a noted Vertebral branch, are partakers of the spontaneous Function) meet with this descending nerve, and are ingrafted into it; it comes to pass from all of them together, that the Excrements being detained at the doors, when it shall be convenient, the Appetite commanding, are cast out. Nature, that it might shun filthiness, is so careful, that for the carrying out of the Excrements it constitutes nervous Vessels, with as noted a provision, as for the performing any where of the most splendid offices.

From the lowest Infolding of the Abdomen, two nerves being sent into the Tunnel, receive there on both sides a noted Vertebral Nerve; and so constitute two infoldings, to wit, one in either side, *Fig. 11. C.C. K.K.* These infoldings near the doors, placed before the chief excretory passages, serve for the opening and shutting them: a Vertebral branch comes to either as a supply; by which it comes to pass, that besides the increasing the forces of the Spirits, their acts flowing from these infoldings, become in some measure spontaneous. By what means and for what end, the nerve ascending from either infolding, is bestowed on the straight Intestine, was shewn but now. Moreover, two descending on both sides, are carried into the neck or porch of the Womb, *Fig. 11. e. g.* Without doubt, whatever of sense or motion is made about the Venereal acts, is owed to the influence of the Spirits through these Nerves. In Men the delightful profusion of the Genital humor, and in Women the no less pleasant reception of the same depends on the action of those nerves. Lastly,
from

from the same infolding another nerve descending and broken into certain shoots, is distributed on both sides into the Bladder and its Sphincter, *Fig. 11. f.* Certainly by these nerves the business of making water is performed, and when at any time the same is painful, the troublesome sense is impressed on them. But forasmuch as the nerves dedicated to the several Excretions proceed on both sides from the same infolding, therefore the acts of them all are in some measure alike among themselves, so indeed, that if any excretory passage should be weak or ill affected, it sends forth its charge which it should keep, whether it will or no. This is so well known, that there is no need to illustrate the matter with instances.

These Nerves and Infoldings being so made, there is not much business besides left for the intercostal pair. About the beginning of the *Os Sacrum*, both Trunks inclining mutually one to the other, communicate among themselves by a cross shoot or two, then they end in very small Fibres, which are distributed into the Sphincter of the *Anus*, *Fig. 11. q. r. s.* Here the intercostal pair is after the same manner, as we have observed concerning the wandering pair; to wit, either nerve being brought to the end of its course, before they enter upon their last task, incline themselves to mutual embraces. Concerning the last offices of either pair, this Conformity may be also noted; that whenas the *Viscera* dedicated to Chylification, to wit, the Ventricle and Intestines, are still continued to the last by the same passage and the same perpetual cavity or hollowness; the first doors of this Cavity, to wit, the Orifices of the Ventricle, are kept by the lowest branches of the wandering pair joyned among themselves; but before the last door of the same, to wit, the *Sphincter* of the *Anus*, the extremities of the intercostal pair, also before joyned among themselves, are placed. But to this part, as if it had never provided enough for it, besides the nerves sent hither from either infolding next above, and these extreme productions of the intercostal pair bestowed on it, a branch also and certain fibres from the Vertebral nerve are inserted, *Fig. 11. i. k.* By the access of which it comes to pass, that the shutting and opening of this door-keeping Muscle becomes spontaneous. Truly many nerves, and those of a diverse kind, are distributed into the *Sphincter* of the *Anus*, to wit, because the nutritious Juice and its stinking recrements, like a certain Chymical matter, are digested within the Intestines, as it were within a *Matrace*; therefore Nature, which best understands Chymistry, is very careful about the well-stopping the mouths of the Vessels.

From the same Nerve, *viz.* the last Vertebral, out of which a branch disperses fibres into the *Sphincter* of the *Anus*, two other Nerves proceed, which are carried into the Yard, *Fig. 11. l. m.* The greater of these, which is very large and long, is distributed into the nervous Body of it; the other lesser, into its Muscles. This member, because it receives nerves only from the spinal Marrow, according to our Hypothesis, ought to swell up and to be moved only at the spontaneous pleasure of the will: but that oftentimes, by reason of the swelling up of the Genital seed or humor, it is erected and blown up with Spirit, whether one will or no, that is caused chiefly for this reason, Because from this Vertebral pair, from whence the nerves of the Yard arise, a nervous process is stretched out into the Vertebral pair next above it: in which the infolding, placed in the Tunnel, imparting nerves to the *Prostata*, is radicated, *Fig. 11. I. K.* into which infolding also a noted nerve from the intercostal pair is implanted. When therefore a communication is had between the *Prostata*, which depend much on the intercostal Nerves and the Yard, (by reason of the roots of either being joyned together by the nervous process) it comes to pass, that the action of this follows the affection of those parts: but those parts, *viz.* the *Prostata*, are apt to be moved not only by the turgescency of the Seed, but also by the passage of the intercostal Nerve are wont to be irritated with too unseasonable an action, according to the impressions made by the Senses or the Brain; into the consent of which presently the Yard is excited.

Concerning the Nerves which belong to the Testicles, here is not much to be spoken; for we have often sought in vain for a great company of nervous passages in them: I have very diligently searched sometimes in Man, also in a Fox, Dog, Calf, and likewise in a Boar and Monkey, but could never find belonging to them but one nerve carried from the Vertebral pair, which also for the most part is bestowed on the Cremasteral Muscle, *Fig. 11. M.* so that, although an excellent humor is prepared within those parts, yet it doth not easily appear, that its matter is derived thither through the nerves; for we think the Genital humor is no more dispensed by the

the nerves than the nutritious. For truly it seems, that the Arteries instil a spirituous liquor into the Testicles after the same manner as in the Brain; wherefore in their neighbourhood these sanguiferous Vessels being very much divaricated or spread abroad, are turned about into little serpentine chanel, whereby they subtilize the humor destinated to the Testicles, and insinuate it, having put off all thickness and Feculency, and being truly sublimated, into their substance; because there, as within the Cortex of the Brain, the spirituous liquor being imbued with a volatile Salt implanted in the part, passes into the most noble *Clyffus*, viz. the Genital humor. But here is not a place to discourse more largely of the nature and origine of the Seed: yet because it is commonly objected, That the Seed is made of the nervous Juyce and plenty of Spirits fetched from the Brain, and therefore a large expence of it doth induce quickly on the Brain and Nerves a great debility and enervation; I say, this comes to pass, because after great profusions of the Seed, for the restauration of the same humor, (of which Nature is more solicitous than for the benefit of the individual) presently greater Tributes of the spirituous Liquor are required from the blood to be laid up into the Testicles: wherefore the Brain is made languid, being defrauded of its due stock and afflux of the same spirituous liquor; and the Spirits influencing it and the nervous *System*, because they are deficient in the Fountain it self, are very much depauperated and become flagging. Besides we may add, That the animal Spirits also which actuate the *Prostata* coming from the spinal Marrow, are consumed about the Venereal acts very much; so that the Loyns are also enervated for this reason.

C H A P. XXVIII.

Of the Spinal Nerve an Accessory to the wandering Pair; also of the Nerve of the Diaphragma.

After we have unfolded the Nerves of the wandering and intercostal pair, which being Executers of the involuntary Function, are stretched out to the *Precordia* and all the *Viscera* of the middle and lower Belly, and also to some other parts: Next to these follow some other Nerves communicating with the afore-said in their beginning, or in the exercise of the same office, viz. the spinal Nerve and the Nerve of the Diaphragma; of which we will speak in order.

We have already shewn, that the Nerve of the wandering pair in the beginning is made up of numerous Fibres: to which is joyned another noted Nerve arising from afar, and being ingrafted with them, goes forth together with them out of the Skull. Concerning this Nerve, because the beginning and distribution of it being very irregular, have not as yet been noted by other Anatomists, it may seem worth our labour to make a little more diligent inquiry. Therefore if we would search into the beginning of this nerve, that is found beginning with a sharp point in the side of the spinal Marrow nigh the sixth or seventh *Vertebra* of the Neck, *Fig. 12. C. C.* But being increased in its ascent, is no where inserted into the medullar Trunk, but in its whole tract on both sides leans on its side, to which it is knit by certain admitted Fibres towards the superficies. This arising up from the Neck after this manner, and being carried within the Skull, is joyned to the Fibres of the wandering pair, and is ingrafted with them seeming to grow together into one Trunk, and goes out with them at the same hole from the Skull; which being passed through, the spinal Nerve presently departing from the Trunk of the wandering pair, is at length reflected outward, *Fig. 9. ♀. ♂.* This stranger or travelling nerve after a short commerce having left his companion, is carried upon the Muscles of the Neck, to which it imparts some shoots, and is inoculated with a certain shoot of the tenth pair; but from thence being carried on further, it goes alone by a long passage, till it comes to the Scapular Muscle, on which it is almost wholly bestowed, *Fig. 9. D.* This nerve is found constantly, not only in Man and four-footed Beasts, but also in Fowls and Fishes; and in these it seems to be destinated instead of Arms, and for the moving of their wings and fins.

Concerning the use of this Nerve, and the reason of its irregular beginning, we shall

shall conjecture after this manner : Forasmuch as that is destined for the performing the motions of the Muscles belonging to the Arms and Neck , therefore it ought to arise out of the spinal Marrow : but that it is not carried by a direct and near way into its Province , but being carried about by a long compass before it enters upon its task, communicates in its beginning with the nerve of the wandring pair ; certainly this seems to be done , to the end that this Spinal nerve , being carried into the parts of the wandring pair, might perform the acts of the Function only involuntary. And indeed it may be observed , That besides the spontaneous motions wherewith the Neck and Arms are wont to be imployed with the previous intention of doing this or that thing , those parts also , before any other member , are affected with pathetick and sudden motions , according to the force of the Passions , the animal not being conscious of it. For almost all living Creatures do not only turn about their necks at any noise to behold whatever might cause fear ; but they being any ways affrighted in the twinkling of an eye fly away , their feet , wings , fins , or other part answerable to them , being set into a rapid motion. The Neck and the Arms are pliable or observant , not only to fear , but in like manner to the other Passions. For brute Animals , as well as Man , being puffed up with pride or anger , (as we have elsewhere intimated) have their Necks swollen , and their Crests lifted up : But as to Man , his hands and arms are so obsequious to the Passions , and almost to all the conceptions of the Brain , that they are continually agitated in the doing of any other thing with various gestures , whereof we are ignorant or not willing them : we scarcely think or speak any thing but at the same time the hands are flung out here and there ; and whilst the Tongue hesitates or sticks , or the words at it were stick between the Jaws , the right hand is exercised , as if by its gesture it were endeavouring to draw out more swiftly the fence of the mind. Truly that these parts , to wit , the Hands and Arms , do so nearly conspire with the Affections of the Brain and Heart in their motions in some measure in all living Creatures , but more eminently in Man , the cause seems to be this nerve's coming from the spinal Marrow to the beginning of the wandring pair , and communicating with its nerves , and receiving from them as it were the note or private mark of the involuntary Function.

So much for the spinal Nerve , which also like a shrub , growing from other shrubs , hath no peculiar origine , but having received various fibres , is radicated for the greatest part in the spinal Marrow , and (as hath been shewn) partly in the nerve of the wandring pair. Concerning the nerve of the Diaphragma , (of which we shall speak next) many things occur no less worthy remarking. As to its beginning , it may be observed , That it arises from the brachial nerves with a double or triple root ; to wit , two or three shoots going out of the aforesaid nerves , grow together into the same Trunk , which is the nerve of the *Diaphragma*. In man its first shoot , which is also the greatest , is produced out of the second Vertebral nerve ; and when the first brachial nerve arises from the same handful of Vertebral nerves going out at this place , the aforesaid shoot is rooted in its origine : wherefore , when in Brutes the first brachial nerve arises from the fourth or fifth Vertebral , the nerve of the *Diaphragma* also begins its rise far lower : two other shoots arise out of the same stocks of the brachial nerves which follow next , *Fig. 9. T. φ.* But the Trunk which is made out of these shoots goes forward single through the passage of the Neck and the cavity of the *Thorax* without any branching forth , even to the *Diaphragma* , *Fig. 9. χ.* where being at last stretched out into three or four shoots , it is inserted on either side to the fleshy or musculous part of it : so that , because the *Diaphragma* is a Muscle , and performs both its motions , to wit , *Systole* and *Diastole* by its own Fibres , the office of either nerve is only to carry bands or forces of animal Spirits requisite for the indisscontinued action of that part , and also to convey thither the Instincts of the Motions variously to be performed.

As to the first use of this Nerve , *viz.* for the passage of the animal Spirits , the business is performed in this Muscle , as it is in the Heart. The Spirits flowing into the *Diaphragma* by the nerves , receive subsidiary Forces , to wit , a sulphureous Copula from the blood , upon whose explosion being still iterated by turns , and the receiving of new , the action of this perpetual moveable depends. Concerning the Instincts of the Motions transmitted by the passage of this double nerve , we may observe , That they are , especially in man , of a double kind : *viz.* either the action of the *Diaphragma* merely natural for the performing of Respiration , is continually reciprocated according to the uses of the Heart and Lungs , and altered many ways in
their

their tenour according to their needs, or secondly, a certain irregular and unusual motion of the *Diaphragma* is wont to be excited at the beck of the Appetite, or from the instigations of other parts; for the which, whilst the rest of the Organs of Respiration are compelled to conspire, the act it self of Respiration becomes after a various manner interrupted or unequal.

1. As to the first of these, viz. the unforced motion of this Muscle, it may be observed, That the *Diaphragma*, with the Muscles of the *Thorax* and the parts of either, conspire in their motion with the action of the Lungs and Heart: and that between all these such a joynt action may be sustained, it is observed, That three or four branches are sent out from the Vertebral nerves, in the branches of which the nerve of the *Diaphragma* is rooted, into the intercostal infolding, Fig. 9. ⑥. and whereas from this infolding the nerves are carried into the Muscles of the *Thorax*, by this means a communication and consent of action is effected between these and the *Diaphragma*. Therefore the *Diaphragma* drawing with it self the Muscles of the *Thorax*, by reason of other nerves, conspires with the *Præcordia*. These in man going from the intercostal nerve, are already described; and in Brutes from the lower infolding of the wandering pair a nerve is sent down into the infolding of the *Thorax*, to which besides so many shoots and certain fibres reaching forth into the nerve of the *Diaphragma*, are instead of such a commerce.

2. The Anomal and irregular motions of the *Diaphragma* proceed from various causes and from the divers instigation of other parts, which also in man become much more signal than in brute Animals; because in him the communication is notable by the nerves reaching out from the Cervical infolding of the intercostal pair into the nerve of the *Diaphragma*; which kind of infolding and nerves are wanting in Brutes.

As to the Species themselves of irregular motions into which the motion of the *Diaphragma* is wont to be perverted, it may be observed, That we are able at our pleasure to stop breathing or respiration for some space, and presently to take it or draw it out. In laughing, weeping, and singing sometimes the *Systole*, sometimes the *Diastole* becomes stronger, and is made frequenter upward or downward with a repeated shaking; which sort of actions of it are made by reason of those near commerces had between the nerve of the *Diaphragma* and other respective parts of the Breast and Face: yea indeed from hence it is effected, (as we have already shewn) that man is peculiarly a laughing Creature. Further, (which we have shewn elsewhere) from the Sympathy which happens between the parts of the Mouth and Face with the *Diaphragma* by those nerves, a good reason of sneezing may be given, and that Problem of *Aristotles* easily solved, to wit, why men alone, or chiefly before other Creatures, sneeze: For the act of sneezing seems to be made for this end, that man may not only clear his Nose, but that all Torpor or heaviness may be shook off for him from the neighbouring Organs of the Senses, yea and from all the fore-part of the Brain: which thing easily succeeds, if the Membranes and nervous passages besmearing the Nostrils and the Sieve-like Bone, like the holes of a Sponge, being strongly wrung forth or squeezed together, be forced to shed forth their moistures; for these parts so emptied, presently like a pressed Sponge, receive other humors, to wit, those coming from the neighbouring parts. In the mean time, that the watry heap so laid up about the caverns of the Nostrils, may be emptied, it ought to be carried away, or wiped out from thence by a vehement blowing of the Air or breath. Wherefore it is observed, That whilst the inward parts of the Nostrils being very sensible, begin to be wrinkled together from some sharp thing pulling or pricking them, and by that means to draw out the watry humor presently by reason of the passage from thence by the branches of the fifth pair into the intercostal Trunk, and from thence by the passage of the nerves which are extended from its Cervical infolding into the nerve of the *Diaphragma*, the consent of the same Action or Convulsion is produced even into the cross bound or Midriff; so that by the same Act as it were with which the Nostrils are wrinkled, the *Diaphragma* also with the *Diastole* being stronger and longer draw out, is depressed, that the Breast being dilated as much as may be, the Air may be the more copiously inspired. Then as soon as the Spasm or Convulsion of the Membranes, drawn together within the Nostrils and fore-part of the Head, begins to remit, presently the Midriff leaping back with a force, causes the inspired Air to be violently exploded or driven out, which strongly wipes away and carries forth with it the humor pressed out within the caverns of the Nostrils.

We yet ought to inquire concerning the Nerve of the *Diaphragma*, what is the reason, that it always proceeds from the Brachial nerves, and why it doth not rather arise immediately from the spinal Marrow. Truly from hence it seems to follow, that the motion of the Arms in some sort respects the action of the *Diaphragma*; or on the contrary, that this depends on that. Indeed between these two a certain respect or habitude happens; which easily appears by this Argument: The Arms or fore Legs in all Creatures are made for labour and hard exercise; because by the force of these men fight, and perform the most hard and laborious things, and Brutes run and ascend the most steep places with great pains. But it is very well known, that by too much labour and over-vehement motion of body, the act of Respiration is very much increased, so that the breath almost fails, and is oftentimes in danger to be lost. The reason of this is, because by great exercise the blood is too much forced into the bosom of the Heart, which, lest it should suffocate it, that it might be emptied into the Lungs, very frequent and difficult Respiration is instituted. Therefore from hence may be inferred, That the exercises of the Body ought to be regulated according to the state of the *Præcordia*; or that the motion of the Arms should observe the action of the *Diaphragma*, viz. lest they being stirred by a violent motion, cause the blood to be driven more into the bosoms of the Heart, than the *Diaphragma* instituting a most frequent Respiration, can draw from thence into the Lungs. That this Rule may be perpetually observed of all living Creatures it is so provided, that the nerve of the *Diaphragma*, chiefly conducing to Respiration, should be tyed, as it were a bridle, to the Brachial nerves, which are the principal in the motion of the Body, and so might timely warn these, if unmindful of their duty, and as soon as breath fails, should command them to desist from further moving the Body. Wherefore we observe, when at any time labouring Cattle are urged beyond their strength in labour or motion, oftentimes either some deadly hurt of the heart follows, or else some incurable disease of the *Diaphragma*; for by such immoderate labour, either the Beast languishing quickly dyes, when it is commonly said, that his heart is broke; or else the tone of the *Diaphragma* being wholly broken, Respiration ever after becomes painful and difficult: which is wont to happen ordinarily to Horses, who are driven into too rapid a course with a full Belly.

CHAP. XXIX.

Of the Reason of the difference that happens between the Nerves of the wandring and Intercoſtal Pair in Man and brute Beasts; also of the other Pairs of the Nerves arising both within the Skull, and from the Spinal Marrow: also something of the Blood-carrying Vessels which belong to the Spinal Marrow.

THUS far we have described all the Nerves stretching out to the *Præcordia* and *Viscera*, also to most of the other parts, which are the Organs of the involuntary Function, according to the manner by which they are wrought in man; and we have shewn their Offices and Uses, and the Reasons of the most noted appearances in all. Before we proceed to the other Conjugations of the Nerves, it behoves us to shew with what difference the aforesaid Nerves are found in brute Beasts, and for what end such a difference is ordained.

It was already intimated, That the Trunk of the wandring pair in four-footed Beasts doth send forth to the Heart and its Appendix more nervous Vessels than in Man. The reason of which is obvious; because the Cardiack nerves in Brutes proceed almost only from this pair, and scarce at all from the intercoſtal; wherefore when they are only of one origination, therefore more are required, all which notwithstanding are much fewer than the same are in Man from a double stock, viz. being carried from both the Nerves: forasmuch as Beasts want prudence, and are not much obnoxious to various and divers Passions, therefore there was no need that the Spirits should be derived from the Head into the *Præcordia* by a double passage, viz.

viz. that one should be required for the exercise of the vital Function, and the other for the reciprocating impressions of the Affections; but that it may suffice, that all those destinated to every one of their offices, may be carried still in the same path.

In most Brutes the intercostal Nerve goes alone from the Ganglioform infolding of it almost without any branching to its infolding of the *Thorax*: in which passage however it is not always after the same manner in all; for in some it is carried single and apart from the Trunk of the wandering pair, nor doth it communicate with it in its whole journey, unless a little higher by a shoot sent down from the Ganglioform infolding: but in many the intercostal Nerve passes presently from its Ganglioform infolding into the neighbouring infolding of the wandering pair, *Fig. 10. C.* where, when both the nerves seem to close together, from thence both being involved under the same common inclosure, as it were one Trunk, they are carried together till it comes over against the first Rib, and there an infolding being made, the intercostal nerve, departing from the wandering pair, is carried into the infolding of the *Thorax*; and the other nerve also is stretched between this and that infolding: which nerves, when one is carried under the other above the Artery of the Chanel-bone, making as it were an handle, straiten its Trunk, *Fig. 10. g.*


Although the intercostal Nerve is carried from the Throat to the top of the *Thorax* under the same sheath with the Trunk of the wandering pair, yet it is not united to it; but they remain distinct still both of them in the whole tract, and the Membrane being dissected, they easily separate one from the other, unless they be knit together by some fibrils sent from one another in some places: but forasmuch as by this means the intercostal nerve being joyned to the Trunk of the wandering pair, goes under its cover, it seems to be so made only for its safety and better passage: wherefore in some perhaps where the intercostal Trunk is greater, or the course of its passage shorter, where such a safeguard is not needful, it descends alone. We have seen this Nerve covered with the safeguard of the wandering pair of one side, and in the other to have gone out by it self alone.




Whether the intercostal Nerve departs from the lower Infolding of the wandering pair or not, however a branch is stretched out between this infolding and that of the *Thorax* in many, perhaps in all brute Beasts, which in its passage binds about the Vertebral Artery, whereby the *Sympraxis* or joynt Action between the *Præcordia* and the exterior Organs of Respiration is sustained: yea from this lower infolding of the wandering pair sometimes we have observed a shoot and fibres to be carried to the beginning of the Brachial branch, in which the nerve of the *Diaphragma* is rooted; also sometimes, though rarely, we have seen some shoots sent from the infolding of the *Thorax* towards the Heart and its Appendix. In a Monkey above this infolding of the *Thorax*, as we have intimated before, were some shoots and small branches reaching from the intercostal nerve towards the *Præcordia*.

We may take notice concerning those Nerves below the *Præcordia*, distributed every where into the Ventricle and the lower *Viscera*, that there is scarce any difference of them in Man and Beasts. The nerve of the *Diaphragma* is placed lower in four-footed beasts: the reason of which is, because the Brachial nerves, out of which that ought to proceed, arise lower; to wit, because Brutes have longer necks, as if destinated to the yoke. These things being thus premised concerning the difference of the Nerves in either Species, it remains that we pass on to the unfolding the remaining pairs of them.

Therefore of those arising within the Skull, the ninth pair is made up of many Fibres also in its beginning, (as was shewed before) out of which being gathered together one Trunk being made is carried towards the Tongue, through whose whole substance, to wit, from the bottom to the top, having passed, it disperses in its whole passage small shoots on either side, *Fig. 9. C.* So that nothing is more obvious than that this nerve performs the motions of the Tongue requisite for the articulation of Sounds, as the nerves of the fifth pair spread into this member, serve for the distinguishing of Tastes; for the exercise of either Faculty, *viz.* both motive and sensitive, the texture of the Tongue being notedly fibrous, hath the virtue of a double Organ; therefore by the two nerves, besides the supplements of Spirits, are carried both the Instincts of the Motion and the sensible Impressions.

That the aforesaid Nerves of the ninth pair may more easily perform the motions of the Tongue, it sends forth downwards one shoot before the entrance of the Tongue, which is united with a shoot from the tenth pair meeting it destinated to

the *Sternothyroideal* Muscle; and the other little branch of the ninth Conjugation is distributed into the Muscles of the Bone *Hyoides*, Fig. 9. . In truth these shoots being sent down as so many little ropes, conduce to the moving of the Muscles, which are fixed to the bottom of the Tongue, which Muscles being placed as so many Props to the Tongue, do facilitate its motion.

The Nerve of the tenth pair, although it may seem to arise within the Skull with many little Fibres also, yet being sent down from thence into the bony Cloisters of the *Spine*, not arising but within the first and second *Vertebra*, it is carried without. Presently after its entrance it sends forth two nerves into the infolding of the intercostal nerve; for what end hath been already shewn: But its chief Trunk spreading downwards, and receiving a shoot produced from the ninth pair, is bestowed on the *Sternothyroideal* Muscle. Moreover, this nerve reflects branches outwards, which are distributed into the Muscles of the Neck reaching out towards the hinder part of the Head; so this pair, as if it were only of the number or rank of the Vertebral nerves, imparts some branches to the intercostal nerve, and all the other shoots and branches of it serve for the performing of the motions of the Muscles of the Neck, Fig. 9. H. . . .

So much for the Nerves arising within the Skull, which (as was shewn) having their being from the parts of the Brain or Cerebel, are destinated to the offices of the spontaneous or the involuntary Function, and are chiefly distributed into the Organs of the Senses or the *Viscera* of the vital and natural Faculty. There remain many other Conjugations of Nerves, the roots or beginnings of which consist in the spinal Marrow, which is only the exterior production of the oblong Marrow. These spinal Nerves, besides some branches that they bestow on the intercostal pair, are employed almost wholly on the musculous stock, and the office of them is to carry outwardly the forces of the Spirits and the Instincts of the Motions to be performed, and to convey inwardly the impressions of sensible things. Forasmuch as the spinal Marrow seems to be derived from the Brain, and is as it were a broad and high road produced or leading from the same, without any paths or tracts inserted to it from the Cerebel, therefore the animal Spirits flowing within its nerves, do almost wholly execute the Acts of the spontaneous Function.

To describe all the several pairs of the spinal Nerves, and to rehearse all their branchings, and to unfold the uses and actions of them, would be a work of an immense labour and trouble: and as this *Neurologie* cannot be learned nor understood without an exact knowledge of the Muscles, we may justly here forbear entring upon its particular institution: but it may suffice concerning these nerves and their medullar beginning, that we advertise only in general what things may occur most notable and chiefly worth taking notice of.

As to the Nerves therefore produced out of the spinal Marrow, it may be observed, That in both sides of it, nigh the outward margine or brim, four or five Fibres arise in the superior brim, and as many in the inferior: either maniple or handful pass through with distinct Fibres the *Pia Mater*, or the lowest Coat of the spinal Marrow, which is as it were the common sheath of them all; but afterwards the Fibres passing through the third Membrane of either margine, (for three cloath the spinal Marrow) they joyn together, and having cloathed themselves with a Coat gotten from the second Membrane, they become as it were one Trunk; which Trunk going out at the space between the knot of the *Vertebra*, is again divided into many nerves destinated to several parts. After this manner in the whole tract of the spinal Marrow, the Vertebral nerves have their birth; but in those places where the *Brachial* and the *Cural* nerves go out, both the thickness and the breadth of the spinal Marrow are increased, and also the handfuls or bands of the Fibres are larger. All these are well represented in Fig. 12.

The *Brachial* Nerves are not only far greater than the Vertebrals, so that they appear as it were large and broad nervous chords; but that they may conspire together, and serve for the strong motions of the Arms, or the fore Legs of Beasts, it is observed, That very many of them are knit together by the cross nervous Processes. These Processes in four-footed Beasts (the fore Legs of whom are destinated for unweariable pains and difficult labour) are produced cross-ways after a curious manner, as may be discerned, Fig. 10. *l. l.* The use of these seems to sustain not only the consent of action in many nerves together, but also their mutual strength; that some bands of Spirits might awaken or stir up others, and for the exercising strongly the locomotive

tive force, they might mutually support and relieve one another. And not much unlike this, the business is about the Crural Nerves, where nervous cords signally large, being produced from the Junctures of the *Vertebrae*, whilst they descend towards the Thigh, they which are above receive in their whole tract the nervous Processes which are sent out still from those below, *Fig. 11. p. p. p.*

We may yet take notice farther concerning the spinal Marrow, that as it sends out Nerves by bands, and as it were by troops, in an orderly series and military order; so its sanguiferous Vessels are disposed with no less signal artifice. For those which are carried in the superficies of the spinal Marrow, and the Arteries, Veins, and other Sanguiducts; which are nigh its compass, do contain some things more rare and highly worth the noting.

In the first place we may observe, That the blood-carrying Vessels do cloath the whole substance or frame of the spinal Marrow, as well as the oblong Marrow with a thick series of shoots; which may be made more manifest to any one, if first of all Ink were injected into the Vertebral Artery; for from such an injection often repeated, it will easily appear, that the infoldings of the Vessels do cover as it were in the shape of a Net; the upper tract of the Marrow. But by what means these Vessels proceed on both sides from the Trunk of the Vertebral Artery, and also the blood-carrying Veins, which are destinated to the whole spinal Marrow, and the inferior portion of its arterious passages, doth not so plainly appear; because the bony Cloisters of the *Vertebrae* are not broken through without much labour, especially in grown up living Creatures; and in that work the beginnings and branchings out of very many Vessels are wont to be blotted out: But that we might more accurately search into these hid things, we made the Dissections of several *Embryons*, in which we were able to dissect the *Vertebrae* as yet soft, and to take out of them the Marrow whole, and to look more narrowly into all the recesses of the Bones: further, that all the tracts and branchings out of them might be the better perceived in all the Vessels, we did cast in divers coloured Liquors. And we had our desired wish: for presently we found with much admiration, that those kind of Vessels, *viz.* Arteries, Bosoms, and Veins, which respect the Head, belong also to the spinal Marrow with no less a noted disposition of provision.

When we did dissect the Heads apart from the Spine, we did think, according to the Opinion of the Vulgar, that the Vertebral Arteries did belong only to the Head: and when there did appear in the cut off Trunk of the oblong Marrow three arterious branches (as they are described above in the first and second Table) therefore in the Explication of either Figure we have affirmed the Vertebral Artery to be carried with a triple branch into the hinder part of the Head. But the Vertebral Artery pays to the superior part of the Spine as great Tributes of Blood as to the Head it self; and that middle arterious branch, which is marked in the first Figure with the Letter T, in the second with S, doth not ascend into the Head, but descends from that course of Vertebral Arteries towards the Spine, and conveys downward from the common flowing together of the blood there made by many Arteries, the *Latex* for the watring the top of the spinal Marrow. Wherefore in this place it seems convenient, that we do not only correct that error of ours, but that we deliver an exact Description of all the Vessels which are destinated to the Spine, *viz.* which contain many wonderful things. As therefore these Vessels are of a threefold kind, *viz.* Arteries, Bosoms, and Veins, we will expose each of them particularly; and first concerning the Arteries we say,

The Arteries which carry the Blood towards the Spine, are disposed after one manner above the Heart, and after another below it. As to the first, whereas the Trunk of the *Aorta* being there cleft presently into many branches, departs from the Region of the Spine, therefore the Vertebral Artery is produced on both sides from its axillary branches, which ascending straight into the hinder part of the Head, sends forth a branch into the meeting together of every *Vertebra*: But below the Heart, forasmuch as the *Aorta*, in its whole descent, lyeth on the Spine, two Arteries are received into the Spine from its bottom nigh its *Internodia* or spaces between the knots of the *Vertebrae*; so that if the Trunk of the *Aorta* be cut open long-ways, there will appear a series of double holes through its whole tract, after a most curious manner, as in the head of a Lamprey.

The arterious Branches which are carried both above and below the Heart towards the Spine, becoming presently forked, bestow one shoot on the neighbouring Muscles,
and

and another they insert into the Junctures of the *Vertebra*; which being carried within the bony Den, is cleft presently into three branches, two of which are bestowed on the medullar Trunk, and the other on the Membrane compassing about the bony Den before, *Tab. 13. Fig. 3. a. b. c. d. e.*

As to the shoots destinated to the medullar Trunk, they presently tending two ways, and meeting with either maniple or band of nervous Fibres, ascend towards their beginnings; and so one little Artery having got to the superficies of the hinder Marrow, distributes into it hairy Vessels: but the other arterious shoot, which is the greater and chiefest, as soon as it attains the margin of the former Marrow, is carried from thence by an oblique passage into the middle fissure or cleft of it, where meeting with a shoot of the pair of the other side, it is united to the same, and from that joyning together the arterious Trunk, as it were a common passage, and made up of either Vertebral shoot, descends into that cleft by the open space of one of the *Vertebra*, and in that short passage both dispenses little Arteries on either side, and also inserts them leaning on the *Pia Mater* more deeply betwixt the sides of the Marrow: and so whereas in the whole tract of the Marrow, the chief Trunk of every Artery is carried into the middle cleft, it seems at first sight, as if the same arterious Trunk were carried under the whole substance of the Marrow from the head to the tail, *Tab. 13. Fig. 1.* Further, as by a concurrence of several shoots of either side, the spinal Artery descends above the cleft of the Marrow; so where the Trunks of the Vertebral Arteries joyn together (which happens to be done sometimes in the hinder part of the Head above the oblong Marrow, and often in the Neck above the spinal) an arterious branch somewhat bigger than the rest is stretched out downwards. This formerly (as we mentioned but now) we mistook for the third ascending branch of the Vertebral Artery. But I have often taken notice, that in Brutes, where the Vertebral Arteries have met together with an acute Angle above the medullar Trunk, they are presently, departing one from another, stretched out directly to either brim of the Marrow, from whence immediately being bent back, they are carried again into a mutual meeting, so that between their two joynings together is made the figure *Rhomboides*, as it is in *Tab. 13. Fig. 1. C.* The reason of which without doubt is this; to wit, that the more rapid course of the blood going towards the Head might be hindred by its flood being a little space divided.

The third Branch of either Vertebral Artery being carried into the anterior Cavity of the bony Den, and being presently made forked, tends to the right and left, and is on both sides inoculated to the next shoot of the same side and by the cross process, they of either side are united after the same manner; and so all the Arteries of this cense or rank receive one another mutually, as it were links of a chain, in the whole tract of the Spine, and are continued in the same bending passage. If Ink be cast into the Trunk of the Vertebral Artery and most of the hollowneses of the *Aorta*, all these Arteries, dyed with the same, will appear a pleasant spectacle, like Net-work, as may be seen *Tab. 13. Fig. 3.*

The top of this arterious Infolding being carried into the Skull, inserts two shoots sent forth straight into the wonderful Net, and imparts two others going out sideways on both sides to the *Dura Mater*: the lower end of the same reaching to the *Os Sacrum*, ends in very small Vessels which serve for the Membrane of the Bones.

If it should be asked, For what end these Arteries being concatenated with such frequent ingraftings are disposed within the Back-bone: This seems to be so ordained for three uses: *viz.* First, These Vessels (as also the passages of the Bosoms) are divaricated after this manner with repeated compassing about, that a constant heat from the blood being so turned about, as it were into frequent Whirlpools, might be supplied about the compass of the spinal Marrow, as it were by a *Balneum Mariae*; even such a manner of office as the *Chorooidal* infolding performs within the infolding of the Brain. Secondly, Care is taken by this means, lest the blood destinated for the spinal Marrow, might flow thither too plentifully, or might be defective in its due influx; for the blood being about to flow into the medullar stock plentifully, is diverted from the little branches *c. d.* into these Emissaries *e. f.* and in its defect the subsidiary provision being called out of the middle infolding through the chanel *e.* into the Vessels *c. d.* is derived into the same medullar Trunk. Thirdly, The use of this arterious infolding seems to be, that the blood may be distributed from its passages into the Membranes, *viz.* which is carried every where from them through the Capillary Vessels; the reliques of which also are sucked back by the little chanel sent out

out of the bosoms. Further, from this Store-house, if necessity urges, a certain provision is had for the wants of the Brain; wherefore from hence the small Vessels end in the wonderful Net.

So much for the Arteries distributed about the *Spine* or Back-bone: the Vessels of the second sort are the Bosoms which come between the Arteries and the Veins for the use of the spinal Marrow no less than of the Head it self, and are here ordained with a more curious implication. But the reason why bosoms are required to these more noble parts, and scarce to any in the whole Body besides, is this; to wit, that about these bodies all manner of extravasation, or any stagnation of the blood, might be hindered: but sometimes the Veins are not sufficiently emptied, that they may presently receive from the Arteries the deposited blood, and so may prohibit any flowing out of it; wherefore the bosoms, as more fit receivers, are destinated to that office, for that their receptacles are larger and soon emptied; and for that reason they may more conveniently derive the blood from either medullar substance, lest it should overflow it in the Head or Spine.

As to the Figure of the Vertebral Bosom, its passages being conform to the arterious infolding, are put under it in the whole tract of the Spine: for after a like manner, in either bosom, which is extended within the cavity of the bony Den, from the hinder part of the Head to the *O. Sacrum*, there is one receiving Vessel, by whose twofold chanels presently the blood is brought back from either superficies of the Marrow into the bosom, and another carrying back, by whose passage the same is exported into the Veins. Moreover, in many Animals (though not in all) the bosoms on either side seem to be knit together upon the knots between the *Vertebrae* by the cross processes, and so communicate between themselves: either bosom in its top is continued into the lateral bosoms of the Head; further, from it on both sides a passage lyes open into the Jugular Vein and into the Vertebral, *Tab. 13. Fig. 4.*

What the use of the aforesaid Bosom is in general was but now intimated; to wit, that the blood deposited from the Arteries in the spinal Marrow, might be presently emptied from thence, and be retained within the more large Cavities of the Bosoms, till it may be transferred into the Veins being made more empty: But the reason of the divers sorts of implications, and the frequent ingraffings which is found about their little chanels, seems to be, that the blood, if by chance it being plentifully heaped up within some part of the bosom, should there stagnate, or be apt to regurgitate into the Marrow, it might be drawn out by those frequent Emissaries here or there into the middle or opposite side: after a like manner it is with the bosoms about the Spine, as when a Country-man digs in his ground frequent cross Furrows for the draining away any superfluous moisture.

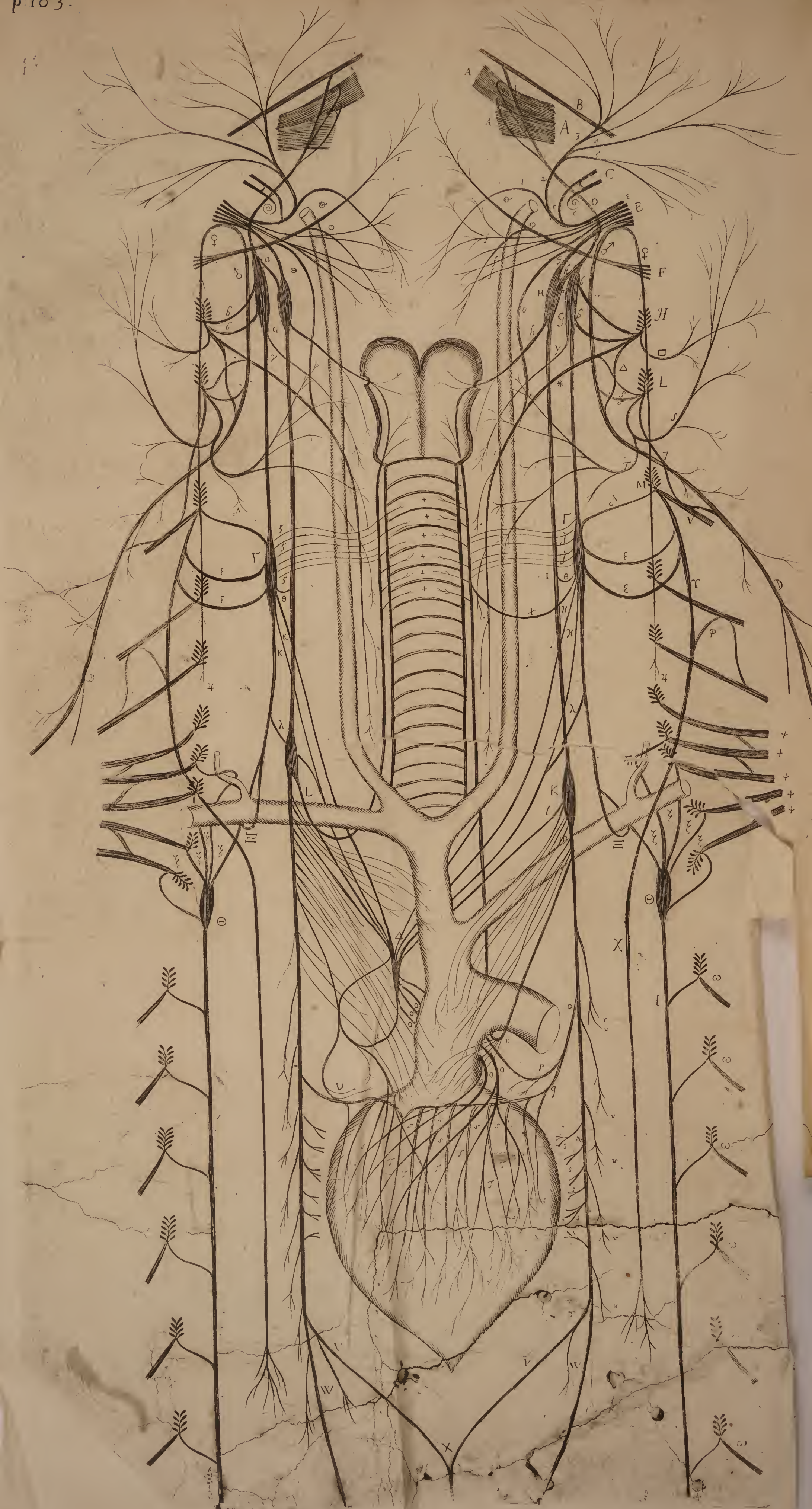
There remains another use of the Vertebral Bosoms, of which we made mention before, to wit, that the blood nigh the medullar Body, being brought through their variously intorted Meanders, (like the arterious infoldings) might yield heat requisite for the swift passage of the animal Spirits, as it were a *Balneum Mariae*. That the bending tracts and complications of the Bosoms may be the better seen, a certain tincture may be cast into the Vertebral Veins; and presently that invading the passages of the bosoms and marking them, will exhibit the appearance of a long Ladder with many little labels hanging to it.

Yea at length by those little roundles we are led to the third kind of Spinal Vessels, which are the Veins, into which all the bosoms immediately convey their burden, whereby they being continually emptied, may be still able to receive fresh blood: wherefore the venous branch is stretched out by the several joyntings of the *Vertebrae* into the bosom, which presently carries away the blood laid up in it, and to be reduced towards the Heart. The Veins designed to this office, after the example of the Arteries, are disposed after one manner above the Heart, and after another below it. As to the first, a branch going from the Trunk of the *Vena Cava* below the Chancel-bone, or the first little Rib of the Breast, accompanies the Vertebral Artery, and ascending by the holes of the Processes between the several *Vertebrae*, inserts a little branch to the Bosom, *Tab. 13. Fig. 2. h. h. h.* Then the top of this Vein being carried towards the hinder part of the Head, is continued into the Trunk of the Bosom, and opened by the other passage into the Jugular Vein. But further, as if these communications were not yet sufficient for the draining away the blood, transverse branches also are stretched out between both Veins, *Tab. 13. Fig. 2. i. i. i.* So manifold diverting places appear, by which it is enough and more than enough provided,
left

lest the blood might flow back towards the medullar Trunk upon any occasion. Below the Heart, because the Trunk of the *Vena Cava* cannot, as the *Aorta*, immediately lean upon the Spine, and carry shoots straight to the same, therefore it sends forth a Vein without a Companion, out of whose Trunk forked or twofold branches being sent forth, go forwards both to the Muscles of both sides and to the Spine it self. Below the Kidneys, seeing there is a space granted for the *Vena Cava* to be carried nigh the Spine, the *Azygos* Vein ends, and from the Trunk of the greater Vein, as from that of the Artery, the Vessels belonging to the Loyns immediately proceed.

These things being lately observed concerning the blood carrying Vessels belonging to the Spine and the hinder part of the Head, and here inserted in the place of an Appendix, ought to be referred to the other Doctrine of this kind, delivered above in the eighth Chapter. In the mean time, that we may return to our purpose, to wit, what remains of *Neurologie*, there is not much more to be met with worthy note concerning the Nerves: For they, as to the greater and chief Ramifications, are almost constantly both in Man and brute Beasts, after the manner we have described them. Sometimes it happens, although very rarely, concerning the divarications of the smallest Shoots and Fibres, that there is some variety: but as to the primary Vessels, and those drawn from them, the Configuration of every pair of Nerves is still the same or alike in all. It now remains, that the Theory of the Nerves, hitherto drawn in words, and so only objected to the Understanding, may also be shewn to the Sense, which will make it clearer. Wherefore we have taken care, that the ingraven Delineations of the wandring and intercostal pair of Nerves, and also of others which are of chief note, and of the Spinal Marrow it self be plainly exhibited. The Figures of these, although taken from a dead Example, yet after many Dissections and a frequent comparing them together according to their several parts, they are described as if from the life; the Lineaments of which with *Characteristical* Notes, that they may be the better and more distinctly perceived, and a large draught of every Figure, equal almost to the Scheme of Nerves in their animated Body, we have caused to be cut: further, because the Contents of either side and of the Cavity between, cannot be at once described in their proper situation; therefore here it is supposed, That the *Spine*, with the oblong Marrow, or the whole medullar Stock, cut in the midst is rolled out, and both sides of it, with the pairs of the Nerves arising in the whole Tract, is turned outward.





The Ninth Table

Shews the beginnings of the fifth and sixth pair of Nerves, and the Roots of the Intercoastal Nerve proceeding from them; moreover, the Origines and Branchings out of the same Intercoastal Nerve and the wandring Pair, and of the accessory Nerve produced out of the Spine to the wandring Pair carried to the Region of the Ventricle. Besides, here are represented the beginnings and distributions of the seventh, ninth, tenth Pair of Nerves, and of the Nerve of the Diaphragma; also the beginnings of the Vertebral Nerves in their whole Tract from the Region of the Nerves inserted in the *Præcordia* and *Viscera* are described, and their Communications with the former. All this whole following Table shews how it is found in Man different from other living Creatures.

- A. The Nerve of the fifth Pair with its two Branches A. A. the upper of which tending straight forwards, distributes shoots into the muscles of the Eyes and Face, into the Nose, Palate, and the upper part of the whole Mouth; moreover, it reflects two shoots a. a. which are the two roots of the intercoastal Nerve: the other lower Branch of the fifth Pair tending downwards, is dispersed into the lower Jaw and all its parts.
- a. a. Two shoots sent down from the upper Branch of the fifth Pair, which meeting together with the other shoot b. reflected from the Nerve of the sixth pair, constitute the trunk of the Intercoastal trunk D.
- B. The Nerve of the sixth pair tending straight forwards into the muscles of the Eyes, out of whose trunk a shoot b. which is the third root of the intercoastal Nerve, is reflected.
- b. The third root of the intercoastal Nerve.
- C. The Original of the hearing Nerves or of the seventh pair with its double Process, viz. soft and hard.
- c. The softer Branch of it which is wholly distributed into the inward part of the Ear, viz. into the muscle lifting up the hammer, and into the shell.
- c. The harder Branch of it, which arising whole without the Skull, and being inoculated with the shoot of the eighth pair e. constitutes with it a single Nerve, which presently is divided into many shoots: of which
 1. is bestowed on the muscles of the tongue and of the bone Hyoides.
 2. Again into more shoots, the upper of which
 3. Into the muscles of the Face and Mouth.
 4. Into the muscles of the Eye-lids and Forehead.
 5. Into the muscles of the Ear.
- D. The trunk of the intercoastal Nerve consisting of the three aforesaid Roots about to pass into the Ganglioform infolding: which infolding of the intercoastal Nerve, brought without the Skull, seems to be the highest knot.
- E. The Original of the Nerve of the wandring or eighth pair consisting of many Fibres, with which the Nerve F. arising out of the Spine, joyns, and being inoculated with them, passes together through the Skull, which being passed, it departs again, and having made a communication with some neighbouring Nerves, is bestowed on the muscles of the Shoulders and Back.
- e. A shoot of the eighth Pair meeting with the auditory Nerve.
- f. f. f. Other shoots of the wandring Pair going into the muscles of the Neck.
- G. The principal Branch of the same Pair being lost or drowned in the Ganglioform infolding being near.
- H. The upper Ganglioform infolding of the wandring Pair which admits a shoot k. out of another near infolding of the intercoastal Nerve.
- h. A Branch out of the aforesaid infolding of the wandring Pair going into the muscles of the Larynx, a noted shoot of which entering into the Shield-like Cartilage, meets with the returning Nerve, and is united to the same.
- i. A shoot sent from the cervical Infolding of the intercoastal Nerve into the trunk of the wandring Pair.
- K. The lower infolding of the wandring Pair from which many Nerves proceed for the Heart and its Appendix.

- l. A noted shoot sent to the Cardiac infolding.
- m. Nervous Fibres distributed into the Pericardium and the Vessels hanging to the Heart.
- n. The left returning Nerve, which being reflected from compassing about the descending trunk of the Aorta upwards towards the Scutiform Cartilage, imparts in its ascent many shoots **** to the rough Artery, and at length meets with a shoot h. sent from the Ganglioform infolding. This returning back from the knot of reflection, sends some shoots towards the Heart.
- L. The returning Nerve in the right side, which being reflected much higher, binds about the axillary Artery.
- O. A noted branch sent down from the trunk of the wandering pair in the left side towards the Heart, one shoot of which presently becoming forked, compasses about the trunk of the Pneumonick Vein; the other attaining the hinder region of the Heart, is dispersed into many shoots which cover over its superficies: a like Cardiac branch sent out of the trunk of the other side, meets with this.
- p. The shoot of the aforesaid branch going about the Pneumonick Vein.
- q. Another branch of the same imparting to the Heart many shoots which cover over its hinder superficies, turned back beyond their proper situation.
- r.r.r. Small shoots sent out of the trunk of the wandering pair which are inserted by a long tract to the Oesophagus.
- S.S.S. Many shoots cut off, the branchings of which being distributed into the substance of the Lungs, variously straiten and bind about the blood-carrying Vessels.
- T.T.T. The trunk of the wandering pair divided into two branches, viz. the exterior and the interior, either of which inclining towards the like branches on the other side, are united to the same, and after a mutual communication constitute the two Stomachical branches, viz. the upper and the lower.
- V.V. The inward branches, which being united in X, constitute the beginning of the lower Stomachical branch.
- W.W. The outward branches, which being united in the Figure to be added to this, make the upper Stomachical branch.
- X. The joining together of the inward branches.
- F. The beginning of the Nerve of the ninth pair with many fibres, out of which being united, a trunk being made is carried towards the tongue; but in its progress sends out two shoots.
- ⊙. ⊙. The first shoot tending downward, and united to a branch of the tenth pair, is bestowed on the Sternothyroeidal Muscle.
- ⊙. ⊙. The second shoot on the muscles of the Bone Hyoides.
- ⊙. The trunk of this Nerve passing into the body of the tongue.
- G. The upper Ganglioform infolding of the intercostal Nerve, which is the highest knot of this Nerve, being come out of the Skull.
- α. A shoot out of this infolding sent into the neighbouring infolding of the wandering pair.
- b.b. Two nervous Processes by which this infolding communicates with the Nerve of the tenth pair.
- γ. A shoot sent down into the Sphincter of the throat.
- Γ. The middle or Cervical infolding, which being proper to man, is placed nigh the middle of the neck in the trunk of the intercostal Nerve.
- ♯. A noted branch out of the second Vertebral pair going into this infolding, whereby this communicates with the Nerve of the Diaphragma in its first root.
- ε.ε. Two branches from the same infolding into the trunk of the Nerve of the Diaphragma.
- ζ.ζ. Many nervous fibres coming from the Cervical infolding into the returning Nerve and into the Blood-carrying Vessels, and are also sowed into the trunks of the Trachea and the Oesophagus.
- θ. A shoot from the same into the trunk of the wandering pair.
- χ. Another signal shoot into the returning Nerve.
- κ.κ. Two signal shoots sent down towards the Heart, which another branch λ. follows, arising a little lower: these being carried downwards between the Aorta and the Pneumonick Artery, meeting with the like branches of the other side, constitute the Cardiac infolding Δ. out of which the chief Nerves proceed which are bestowed on the Heart.
- λ. A branch proceeding a little lower from the intercostal trunk, which is destined with the former to the Cardiac infolding.
- Δ. The aforesaid Cardiac infolding.
- μ. The handle going from the same, which binds about the Pneumonick Artery.

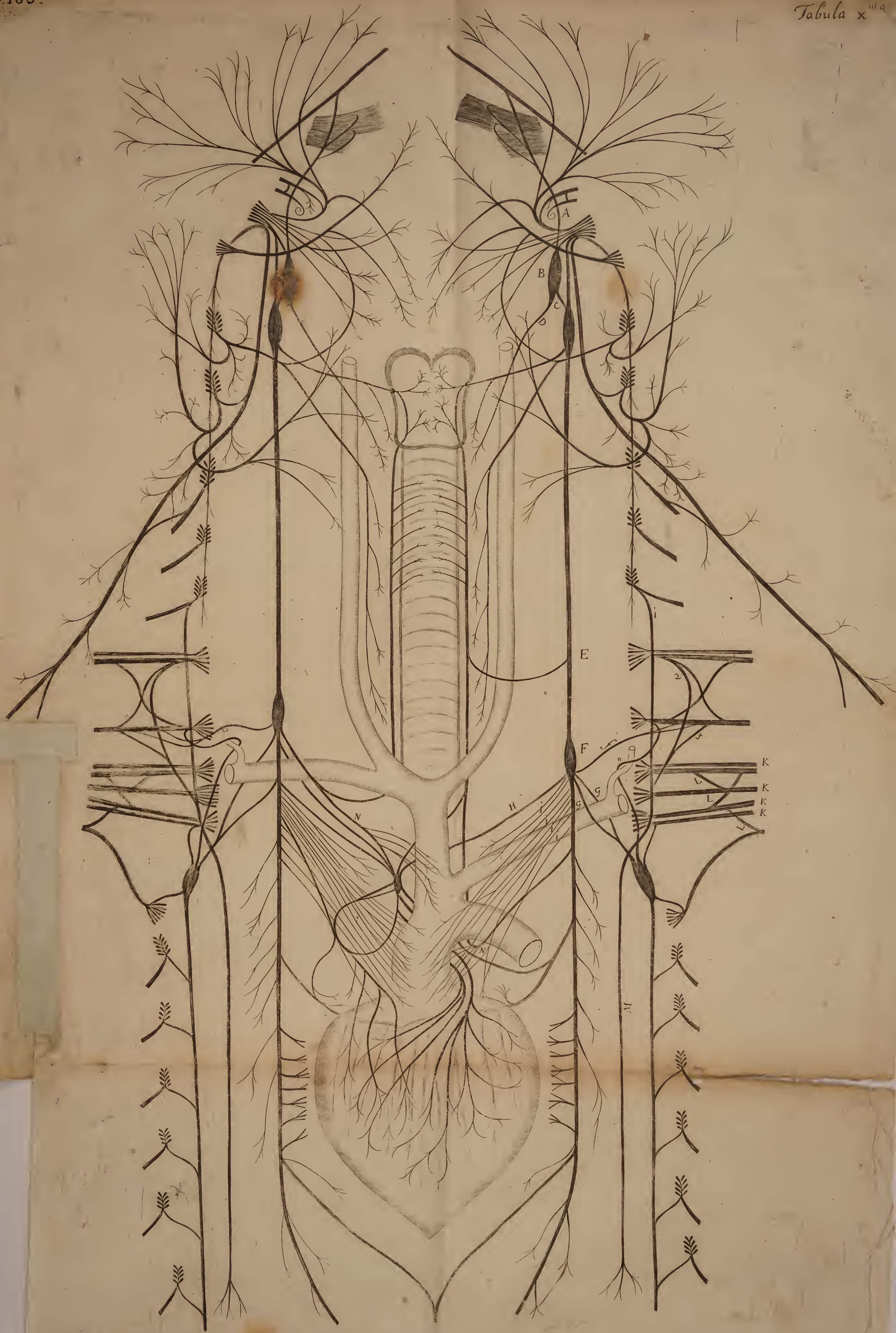
- v. The lower handle binding the pneumonick Vein.
- z. The intercostal Nerve demersed into the cavity of the Thorax, where it binds the axillary Artery.
- ξ.ξ.ξ.ξ. The four Vertebral Nerves sent down into the infolding of the Thorax, the upper of which binds the Vertebral Artery.
- ο.ο.ο. Three noted branches sent down from the Cardiack infolding, which cover the anterior region of the Heart, as the Nerves p. q. going from the trunk of the wandering pair, impart branchings to its hinder part.
- π. The Vertebral Artery bound about by the Vertebral Nerve.
- ς.ς.ς. Nervous shoots covering the anterior region of the Heart.
- τ.τ.τ. Shoots and nervous Fibres distributed to its hinder part.
- Θ. The lower Infolding, called properly the Intercostal or Thoracical, into which, besides the intercostal Nerve, four Vertebrales are inserted: the uppermost of these in its descent binds about the Vertebral Artery.
- I. The intercostal Nerve descending nigh the roots of the sides through the cavity of the Thorax, where in its whole progress it admits a branch from between the several knots of the Vertebrae.
- H. The Nerve of the tenth pair, consisting of many fibres in the beginning, arises between the first and second Vertebrae, where presently it sends forth two nervous processes b. b. into the upper infolding of the intercostal Nerve.
- * A branch of it, which being united to a shoot of the ninth pair, is bestowed into the Sternothyroidal Muscle immediately lying on the rough Artery.
- . A shoot reflected into the posterior muscles of the Neck.
- △. A shoot into the pathetick Spinal Nerve.
- ♦ ♦ ♦ Shoots from the chief branch of the same Nerve into the Sternothyroidal Muscle.
- L. The original of the chief Vertebral Nerve, which in this, as in all other Vertebrales, consists of many Fibres; one band of which going out of the lower margine of the Spinal Marrow, and another from the upper, meeting, go together into one trunk, which is presently divided into nerves distributed many ways.
- g. A shoot from this Nerve into the branch of the tenth pair.
- e. Another shoot into the Spinal Pathetick.
- c. A noted shoot sent forth upwards into the muscles of the Neck and Ears.
- T. A shoot from the crooked Nerve into the muscles of the Neck.
- 7. A Nerve from this pair into the first brachial nerve, out of which the nerve of the Diaphragma hath its highest root.
- M. The beginning of the second Vertebral, out of which the upper Brachial branch proceeds, and in which the nerve of the Diaphragma is first rooted. This Brachial nerve in four footed Beasts arises near the fourth or fifth Vertebrae, and so the root of the Diaphragma is placed lower.
- v. The Vertebral branch destinated to the Arm.
- γ. The Nerve of the Diaphragma, a shoot of whose root δ. comes to the Cervical infolding, and a little lower two other branches from the same infolding ε.ε. are reached out into its trunk. This communication is proper to man.
- φ. The other root of the Diaphragma from the second and third Brachial nerve.
- χ. The lower trunk of the nerve of the Diaphragma being removed out of its place, which in its proper situation, passing through the cavity of the Thorax without any communication, goes straight forward to the Diaphragma, where being stretched out into three shoots, it is inserted into its musculous part.
- ψ.ψ.ψ.ψ. The other Brachial nerves, out of whose roots nerves go into the intercostal Infolding.
- ω.ω.ω.ω. The beginnings of the Vertebral nerves, from the several roots of which a branch is carried into the intercostal nerve.
- υ.υ. The last beginning of the Spinal accessory Nerve, going to the wandering pair, beginning with a sharp point.
- ♀. The trunk of the same Nerve ascending, which in its whole ascent, going through the side of the Spinal Marrow, passes through the midst of the beginnings of the Vertebral nerves, and receives Fibres from the stock of the Marrow.
- ♂. The trunk of the same Nerve descending, which departing from the wandering pair, is reflected outwards, and after having had communications with the nerves of the ninth and tenth pairs, it is bestowed wholly on the muscles of the Shoulder.
- ♂. The lower process of the same Nerve.

The Tenth Table

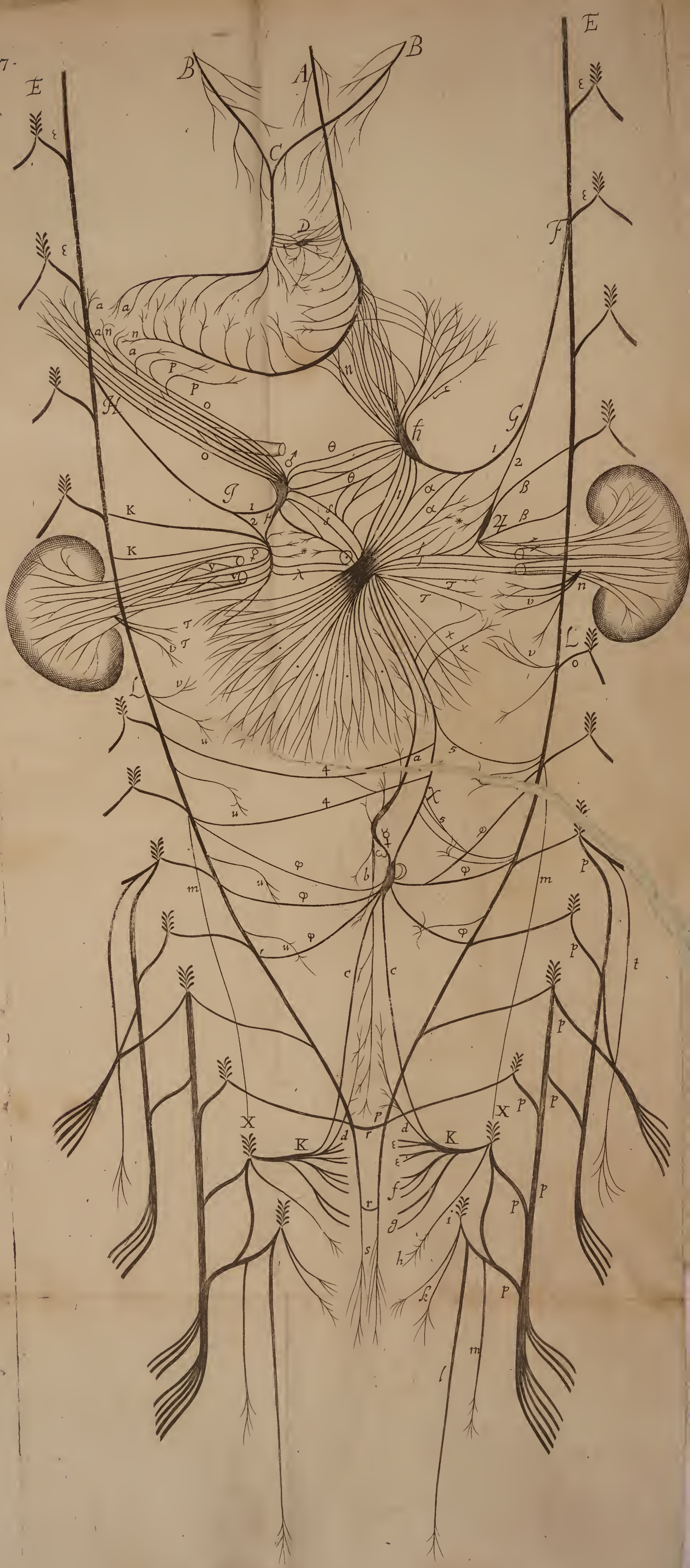
Shews the beginnings and Branchings out of the same Nerves which were described in the former Table, as some of them are found in brute Beasts otherwise than in Man.

- A. *The trunk of the intercostal Nerve going out of the Skull.*
- B. *The upper Ganglioform infolding springing out of the trunk of the intercostal nerve.*
- C. *The intercostal nerve arising out of the aforesaid proper infolding, and sent down into the other neighbouring infolding of the wandering pair.*
- D. *A shoot from the upper infolding into the Sphincter of the throat.*
- E. *Both the Nerves included in the same sheath, as if they were the same trunk, descend towards the Thorax: out of which trunk appearing in this place, a branch is sent out into the returning nerve.*
- F. *The lower infolding in the trunk of the wandering pair, or rather consisting in the common sheath of either nerve.*
- f. *A shoot out of this infolding into the Brachial branch coming between, in which branch the nerve of the Diaphragma hath its root.*
- G. *The intercostal Nerve departing from the same infolding, and going under the axillary Artery, is inserted into the infolding of the Thorax.*
- g. *Another Branch going between the two infoldings, and going above the axillary Artery, so that these two nerves having made an handle, bind about the Artery.*
- H. *A noted shoot out of the aforesaid infolding of the wandering pair into the Cardiack infolding.*
- i.i.i.i. *From thence many nervous Fibres are sent down into the Vessels belonging to the Heart, and into the Pericardium.*
- k.k.k.k. *The greater Brachial nerves which are produced a little lower in Brute animals, than in Man: and therefore the nerve of the Diaphragma arises lower.*
- L.L.L. *The Brachial nerves mutually cutting one another by the cross processes, communicate among themselves.*
- M. *The Nerve of the Diaphragma consisting of three roots, when in Man they are only two.*
 - 1. *The first root of the same Nerve.*
 - 2. *Its second Root.*
 - 3. *Its third Root, which communicates mediately with the infolding of the wandering pair, viz. by the trunk of the Brachial branch, to which it is fixed.*
- n. *A Nerve carried from the second Brachial branch into the intercostal infolding, which binds about in its passage the Vertebral Artery.*
- N. *Shoots and suckers sent down from both knots of the returning nerve towards the Heart and its Appendix.*

The other Nerves and their Branchings out are as in the other Figure, which shews the pattern of them in Man.







The Eleventh Table

Shews the lower Branchings out of the wandring and the Intercoſtal Pair diſtributed to the Ventricle and the *Viſcera* of the Abdomen; alſo the beginnings of the Vertebral Nerves, which are placed over againſt the former, and are ingrafted into ſome of them. The Figure of theſe in Man and in four-footed Beaſts is almoſt alike, ſo that this Table may be common for both.

- A. The lower Stomachical Branch which is made up out of the internal branches of each wandring pair, being united together, and covering the bottom of the Ventricle, diſperſes ſhoots on every ſide in the whole tract.
- B. The upper Stomachical Branch which is made out of the external branches of the wandring pair, on either ſide united together, and creeps through the top of the Ventricle.
- C. The Coalition or joyning together of the Branches.
- D. The nervous Infolding out of the Fibres of both the Stomachical nerves, being united together nigh the Oriſce, and as it were woven into a Net.
- a.a. The ends of both the Stomachical nerves which there meet with the nerves of the Liver, and communicate with them.
- E.E. The Intercoſtal nerve deſcending on either ſide nigh the roots of the Ribs, and in its whole deſcent receiving a branch from the ſeveral Vertebral nerves e.e.
- F. A branch going out of the Nerve of the left intercoſtal ſide, and ſent down towards the Meſenterick infoldings.
- G. The ſame Meſenterick nerve becoming forked, ſends out the greater branch into the infolding, which is the Stomachical and Splenetick, and the leſſer into that belonging to the Reins.
- H. The like Meſenterick branch going out of the intercoſtal nerve on the right ſide, and inclining towards the Meſenterick infolding.
- I. The greater Branch of this nerve becoming in like manner twofold, the greater branch going into the Hepatick, and the leſſer into the Renal infolding, or that belonging to the Kidneys.
- h. The chief Meſenterick Infolding of the left ſide, which is alſo the Stomachical and Lienary, or belonging to the Spleen; out of which many little bundles of Nerves or numerous Conjugations are ſent out many ways.
- u. The Renal Meſenterick Infolding of the left ſide, into which, beſides the Meſenterick ſhoot,
- β.β. two other Nerves are carried immediately out of the Intercoſtal nerve.
- γ.γ.γ. From this Infolding, planted near the Biliary Cheſt, many Nerves and Fibres are ſent into the Kidney.
- δ.δ. Nerves and Fibres by which this infolding communicates with the greateſt infolding of the Meſentery.
- ζ. The chief bundle of Nerves tending out of the former infolding h. into the Spleen, which it having reached, reflects from thence certain Fibres into the bottom of the Ventricle.
- n. The ſecond Conjugation of the Nerves from the aforeſaid infolding into the bottom of the Belly, whoſe Fibres communicate with the ſhoots and fibres of the lower Stomachical nerve.
- θ. The third Conjugation of Nerves between this infolding and the neighbouring Hepatick δ.
- ι. The fourth Conjugation of the Nerves between this and the greateſt infolding of the Meſentery ○.
- ♀. The Renal Meſenterick Infolding of the right ſide, into which (as in its fellow) beſides the Meſenterick branch,
- K.K. two nerves are produced from the intercoſtal nerve.
- λ. The Nerves and Fibres between this infolding and the greateſt of the Meſentery.
- μ. A noted Branch between this infolding and the neighbouring Hepatick.
- v. A noted Company of Nerves and Fibres from this infolding into the Kidney, which climb over the emulgent Veſſels, and variously bind them about.
- ♂. The ſuperior Meſenterick Infolding of the right ſide.
- ο. A great Conjugation of Nerves out of this Infolding into the Liver and Gall-Cheſt,

out

out of which also many shoots are distributed into the Pylorus and Pancreas. The Nerves and Fibres of this, in its ascent towards the Liver, cover the Hepatick Artery, by making as it were a little Net, and almost hide its trunk. The shoots of these meet with the tops of the Stomachical nerve a.a.

τ.τ. Shoots distributed about the Pylorus.

p.p. Other shoots dispersed into the Pancreas.

ς.ς. Nerves reaching out between this Infolding and the greatest of the Mesentery. This infolding communicates with the neighbouring Renal by μ. and with the Stomachical by θ.

⊙. The greatest Mesenterick infolding out of which a mighty bundle of Nerves arising under the great Glandula of the Mesentery, from thence is dispersed on every side about into many shoots and branches, and they are distributed into all the Intestines, except the straight Intestine. The Nerves and Fibres reaching out on every side, are knit to the Mesenterick Arteries and Veins in its whole compass, and variously strain and bind them about.

τ.τ. Nervous shoots from this Infolding into the Womens testicles, or the uterine Glandula's, which meet with the branches of the Vertebral nerves of the twentieth and one and twentieth pair sent into the same parts, and are inoculated with them.

v.v. The Vertebral branches into the Womens testicles.

⊙. The lowest Infolding of the Mesentery placed much below the former, and having for its beginning three nerves on either side arising lower from the Intercostals.

φ.φ.φ. Three Nerves on either side sent down from the intercostal nerve into the lowest infolding of the Mesentery.

χ.χ. A Nerve stretching out of that Infolding directly into the greatest infolding of the Mesentery, which in its passage receives on both sides some shoots from the intercostal nerve, viz. 4. 4. 5. 5. 5. and it self sends two shoots into the Womens testicles.

‡.‡. Two branches from the aforesaid Nerve into the Womens testicles.

♀. Another small Infolding standing a little above this lowest.

ω. Anervous Proceß reaching out of the aforesaid lowest Infolding into the neighbouring very little infolding.

a. From the least Infolding ♀. a noted nerve being carried into the greatest infolding of the Mesentery, which in its whole ascent stretches under the straight Intestine and part of the Colon, and inserts frequent shoots into them.

b. Another Branch sent from the same Infolding downward, which stretches under the lower part of the same straight Intestine, and imparts to it frequent shoots.

C.C. Two Nerves sent downward from the lowest infolding of the Mesentery ⊙, which being sent down into the Basen about the lowest cavity of the Belly, enter the two infoldings there K.K. viz. one placed in either side.

K.K. A double Infolding placed within the Basen, whose nerves provide for the several excretions there made, viz. of the Urine, Dung, and Seed; these send out nerves d.d. towards the lowest Mesenterick infolding.

d.d. A nerve ascending from the aforesaid Infolding on either side, nigh the sides of the straight Intestine, inserts shoots into it; which double infolding, another nerve descending (b) from the least infolding, meets with.

ε.ε. Two Nerves from the same Infolding into the Womb.

f. A nerve from the same Infolding into the Bladder.

g. A nerve into the Glandules Prostatæ.

h. A nerve out of the Root of the eighth and twentieth Vertebral pair into the muscles of the Anus.

i. The nine and twentieth Vertebral pair, from which

k. goes a Nerve into the Sphincter, and the other muscles of the Anus.

l. A noted nerve on both sides from that pair into the Yard.

m. Another shorter Branch into the muscles of the Yard.

L.L. The intercostal nerve below the Reins.

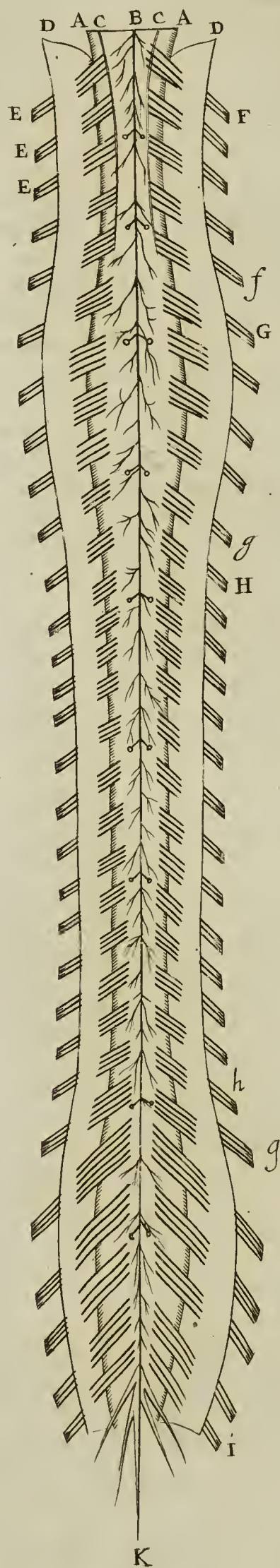
m. A little nerve from the Vertebral branch into the Cremasteral muscle of a Mans Testicles.

n. The one and twentieth Vertebral pair; the beginning of which being placed behind the Kidneys, lyes hid. From this Nerve very many shoots are sent out on both sides into the testicles of the female Sex, which meet with other Mesenterick shoots, distributed to the same part.

o. A



P.189.



- o. *A Nerve from the two and twentieth Vertebral pair, out of which also are some shoots sent into the Womans testicles.*
- P.P.P.P.P.P.P.P. *Nerves destinated for the thigh, of which those that arise higher, receive in their descent branches from the nerves arising lower.*
- q. *The intercostal Nerves inclining mutually one to the other, near the beginning of the Os Sacrum, communicate by the cross Process.*
- r. *Another cross Process within the crookedness of the Os Sacrum knitting together the two intercostal nerves.*
- s. *Both the intercostal Nerves ending in most small fibres, which fibres are distributed into the very Sphincter of the Anus.*
- t. *A Nerve from the twenty fourth Vertebral pair, which is carried into the inguinal Glandula's or of the Groyn.*
- v.v.v.&c. *Shoots sent down from the intercostal Nerve on both sides into the body of the Ureters.*
- x. *A Nerve which is destinated to the Testicles and the Cremasteral Muscle, cut off where it goes out of the Abdomen.*

The Twelfth Table

Shews the Spinal Marrow whole taken out of its bony Den, and half taken from the Membrane cloathing it, being dissected, that the beginnings and productions of all the Vertebral Nerves might be seen together.

- A.A. *The top of the Spinal Marrow, where it is cut off from its cleaving to the oblong Marrow.*
- B. *The Spinal Artery seen to descend through the whole Marrow, which however is made up of Arteries, brought into it from between the several joyntings of the Vertebrae.*
- C.C. *The Spinal Nerve coming from the fifth or sixth Vertebra of the Neck to the beginning of the wandering pair.*
- D.D. *Portions of the Membrane cloathing the Marrow dissected and rolled off.*
- E.E.E. *The Spinal Nerves sent out of the upper margine of the Marrow by bands, with which the like bundles also being carried from the lower margine, meet and joyn together all into one trunk within the junctures of the Vertebrae: then being separated again without them, they are carried into their respective Provinces.*
- F.f. *Nerves brought forth within the region of the Neck.*
- G.g. *Nerves destinated for the Shoulder and Arm, where both the Marrow is larger, and the bundles of the nerves are greater.*
- H.h. *Nerves going out about the Back and Loyns: where both the body of the Marrow is again smaller, and the little bundles of the nerves are a little slenderer.*
- I.i. *Nerves destinated for the thighs, where also the medullar body and the little bundles of the nerves are again larger.*
- K. *Nerves going out of the Os Sacrum.*

The Thirteenth Table.

FIGURE I.

Shews the branchings forth of the Vertebral Artery reaching out on both sides into the superiour part of the Spinal Marrow, and into the hinder Region of the oblong Marrow.

- A.A. *The Region of the posterior oblong Marrow.*
- B. *The common passage made from both the Vertebral Arteries united together.*
- C. *The Rhomboidal Figure, which in Brutes a double coalition of the Vertebral Arteries describes.*
- D. *The first joyning together of the Vertebral Arteries above the Spinal Marrow, from which place the Spinal Artery descends.*
- E. *The Spinal Artery.*
- F.F. *Two Vertebral Arteries carried from the axillary branches.*
- G. *The Spinal Marrow.*
- f.f.f.f.&c. *Arterious shoots into the muscles of the Neck.*
- g g g.g. *Shoots sent in the Spinal Marrow which joyn together from either side in the Spinal Marrow nigh the several joynings of the Vertebræ.*
- h.h.h.h. *Arterious shoots, which following the chanel of the Bosoms, make the arterious Infolding, as it is described in the third Figure.*
- f.f. *Two Arteries sent down from the Aorta into the Spine.*

FIGURE II.

Shews the Vertebral Veins which are Companions to the abovesaid Arteries; also the upper portion of the Vertebral Bosom and the communications of either among themselves and lateral Bosoms of the Head, and between the Jugular Veins.

- A. *The third Bosom of the Head cut off, where it passes into its lateral Bosoms.*
- B.B. *The lateral Bosoms of the Head.*
- C.C. *The round Den where the lateral Bosom goes on both sides into the Jugular Vein.*
- D.D. *The Jugular Vein.*
- E. *The upper joynting of the Vertebral Bosoms.*
- F.F. *The Vertebral Bosom on either side within the Skull brought through, and there passing into the lateral Bosom.*
- G.G. *The trunk of either Vertebral Vein brought from the Vena Cava, and there beginning.*
- H.H. *Either trunk of the Vertebral Bosom there cut off, which lower is continued through the whole passage of the Spine.*
- h.h.h.h.h.h. *The joynings together on both sides within the Commissures of the Vertebræ between the Vertebral Vein and Vertebral Bosom.*
- i.i.i.i. *The Veinous passages, which reaching out before without the Vertebræ, are carried from the Vein of one side to its fellow of the other side.*
- i.i. *The communication of all the Bosoms and Veins in the top of the Spine.*
- k.k. *The Veinous passage from the concurrence of the Bosoms and Veins on both sides into the Jugular Vein.*
- l.l.l.l.&c. *The joynings together of the Bosoms of either side near the Internodia of the Vertebræ.*
- m.m.m.m.&c. *The passages of the Veins carrying back the Blood from the Spinal Marrow into the Bosoms.*
- n.n.n.n.&c. *The Chanels of the Veins carrying back the Blood from the muscles of the Neck.*

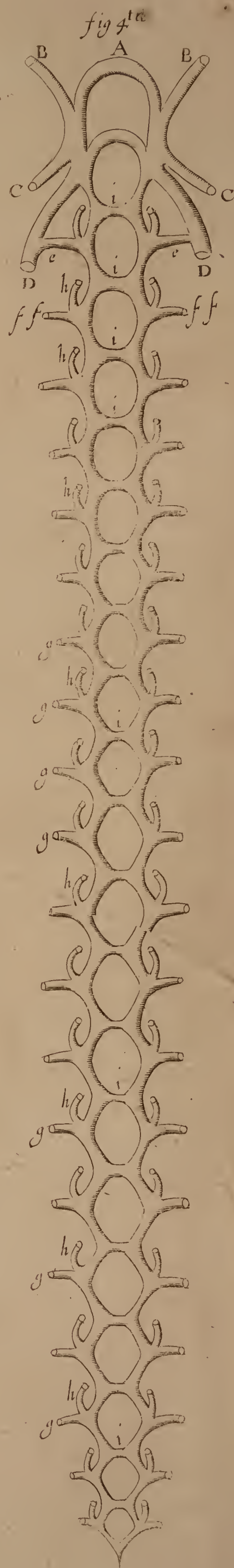
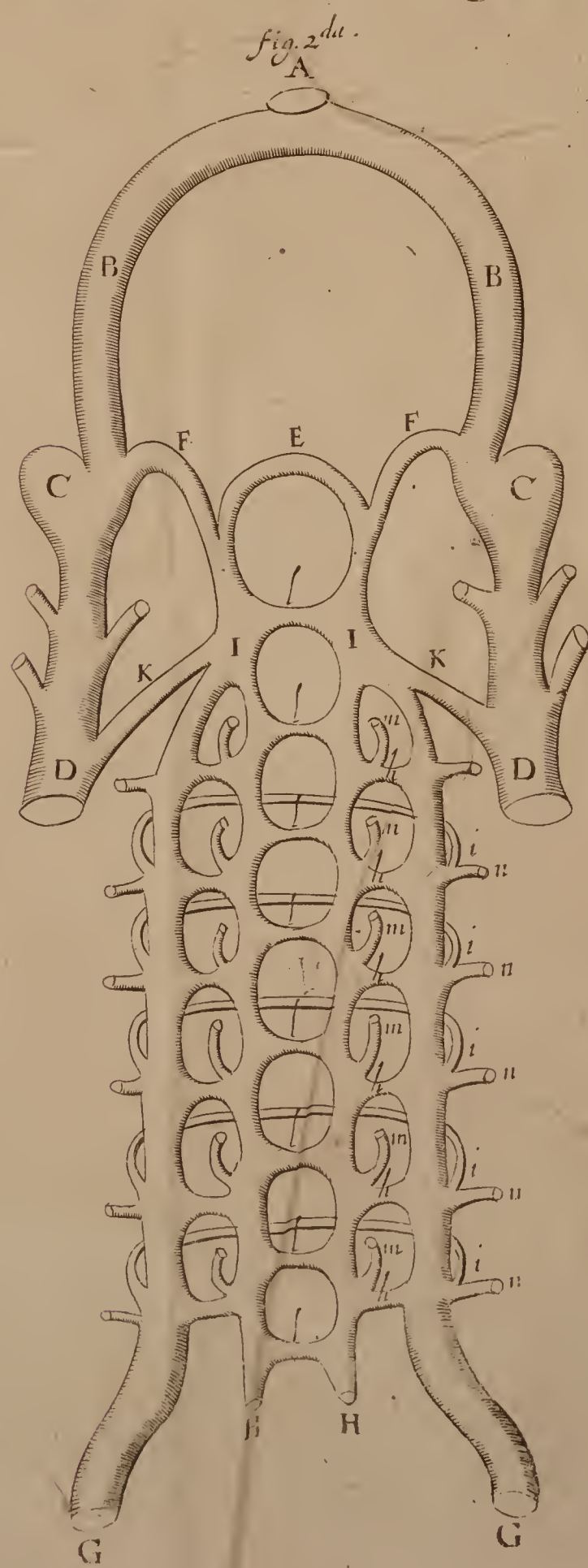
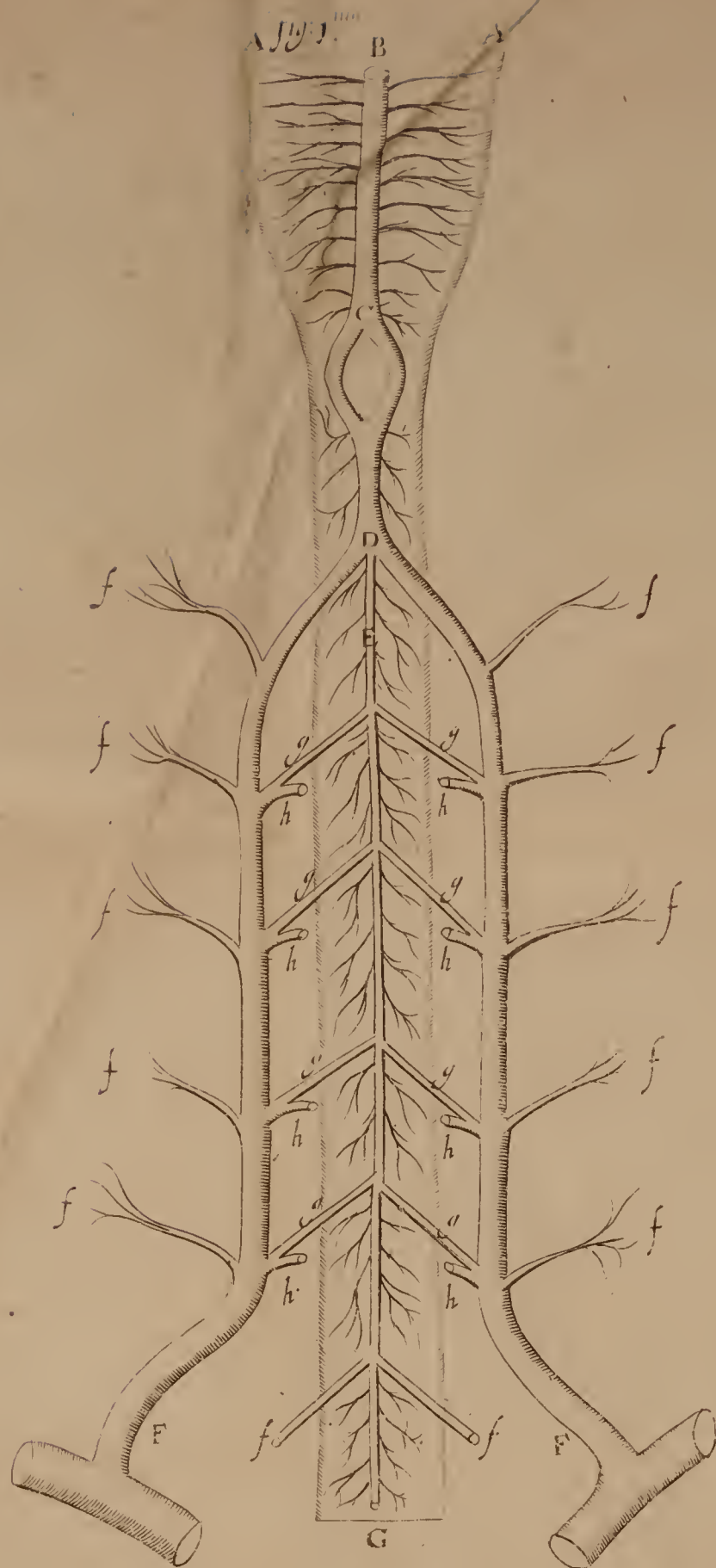
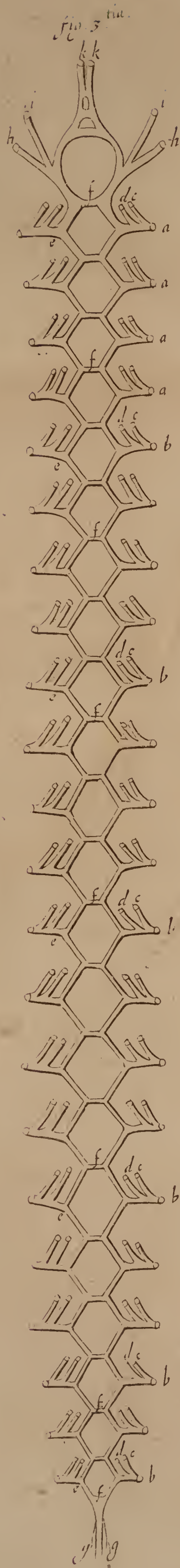


FIGURE III.

Shews the Spinal Artery which is produced within the bony Den nigh the more inward Superficies of the Marrow, from the hinder part of the Head to the Os Sacrum, in the shape of a Net-work purl.

- a.a.a.a. *Arterious shoots sent towards the Spine from the Vertebral Artery ascending between the holes of the Spinal Processes.*
- b.b.b.b.&c. *Arterious shoots sent from the Aorta towards the Spine.*
- c.c.c.c.&c. *An arterious shoot reaching out of every of the aforesaid shoots into the posterior Marrow.*
- d.d.d.d.&c. *Another shoot reaching out of every of the aforesaid shoots into the anterior Marrow.*
- e.e.e.e.&c. *Every the aforesaid arterious shoots, as soon as carried into the bony den becoming forked, send forth a little branch into either part, which on both sides communicates with the next branch of the same side, and by the cross Process with the fellow-branch of the other side.*
- f.f.f.f. *The joynings together of the Arteries of either side by the cross shoot.*
- g.g. *The arterious shoots going out of the Os Sacrum.*
- h.h. *Arterious shoots into the Meningæ of the hinder part of the Head.*
- i.i. *Arterious shoots going out of the Skull with the Nerves of the seventh pair.*
- k.k. *Shoots reaching out into the wonderful Net, which in their progress are ingrafted mutually among themselves, and also with the Arteries Carotides.*

FIGURE IV.

Shews the Branchings out of the Spinal Bosom in its whole passage.

- A. *The uppermost joyning of the Bosoms of either side.*
- B.B. *Chanel reaching out of either Vertebral Bosom into the lateral Bosoms of the Head.*
- C.C. *Chanel brought from the common concourse of the Bosoms, and the Vertebral Veins into the Jugular Veins.*
- D.D. *The Vertebral Veins.*
- e.e. *A communication between the Spinal Bosom and the Vertebral Vein.*
- f.f.f.f. *The passages of the Veins from either Bosom into the trunk of the Vertebral Vein.*
- g.g.g.g.&c. *The like Venous passages which are continued lower into the branches of the Vein Azygos, and lastly into the lumbar shoots of the Vena Cava.*
- h.h.h.h.&c. *The Pipes of the Veins, which receiving the blood from the Spinal Marrow carry it back into the Bosoms.*
- i.i.i.i.&c. *The Commissures or joynings of the Bosoms of either side nigh the several joynings of the Vertebrae.*

FIGURE V.

Shews the Image of the Spinal Bosom in a Dog, which hath not joynings together in its whole passage, as it is in a Calf, Sheep, Hog, and many others, but only in the west and uppermost part, where it communicates with it self by three or four Os Processes.

THE CONCLUSION.

THUS much for the Anatomy of the Brain and Cerebel, and of their Appendix, both Medullar and Nervous, and of the Uses and Offices of all the several Parts, of which we have largely treated. There yet remains, after we have viewed, not only the outward Courts and Porches of this Fabrick, as it were of a certain Kingly Palace, but also its intimate Recesses and private Chambers, that we next inquire into, what the Lady or Inhabitant of this Princely place may be, in what part she doth chiefly reside, and by what Rule and Government she disposes and orders her Family. Then we ought to take notice, what defects and irregularities happen to it, or to its parts and powers; then to what injuries of changes or Diseases this Building or House, to wit, the Brain and nervous Stock, may be obnoxious. For indeed I am as it were bound, by reason of the Work it self, and the promise I made before, that for the Crown of the Work, a certain Theory of the Soul of Brutes should be added after the naked Anatomical Observations and Histories of Living Creatures, and of their animated Parts. Truly it is but just and equal, that we enter upon this Discourse of the Soul, and that other task of *Pathologie*, to wit, that the Asperities and hard sence of our already instituted *Anatomy* may be sweetned with those kind of more pleasant Speculations, as it were cloathing the Skeleton with flesh; and that the Reader being wearied by a long and troublesom Journey, may be a little refreshed and recreated. For in truth, whatsoever of our Work is performed without form or beauty, may seem as the Foundation of a Building only placed on the ground, in which no elegancy or neatness doth yet shine, but that all things appear rude, and as yet built of rough and unpolished stones. A Superstructure indeed may be promised to be put upon this Foundation, perhaps fair and beautiful, whereby the minds of the Beholders may be pleased and instructed. But truly this kind of work may be too hard and great to be performed by our weakness: neither doth it become me to proceed in my undertakings, before these have undergone the Censure and chance to which they are subject. For I fear, lest this Foundation, but now laid, should become too weak and feeble for the sustaining an higher Fabrick, at least until this hath for some time undergone the tryal, by lying open to winds and storms.

FINIS.

A N
E S S A Y
O F T H E
P A T H O L O G Y
O F T H E
B R A I N
A N D

Nervous Stock:

In Which

Convulsive Diseases

Are Treated of :

Being the Work of *THOMAS WILLIS*
of *Christ-Church* in *Oxford*, Doctor in Physick, and
Sidly-Professor of Natural Philosophy in that
Famous Academy.

Translated out of *Latine* into *English*, By *S.P.*

L O N D O N,

Printed by *J.B.* for *T.Dring*, at the Signe of the *Harrow*
at *Chancery-Lane-End* in *Fleet-street*. 1681.

The Authours Epistle Dedicatory.

To the Most Reverend Father in Christ, His Grace, Gilbert, by Divine Providence, Archbishop of Canterbury, Primate and Metropolitan of all England, and One of His Sacred Majesties most Honourable Privy Council.

IT is so Ordained by the Laws, most Noble Prelate, that whatsoever shall happen to be built upon any ones ground, it shall be his own, by right of accession. Since therefore, to that work which I lately attempted, concerning the gifts and Nature of the Sensitive Soul, as also the Affections of the Brain, and nervous stock, and the various Diseases which belong to them; I had placed the Anatomy of the humane Head for a foundation; it was altogether necessary (this Treatise being Dedicated to your Grace) that whatsoever building should be raised on that Foundation, should truly, and rightly be said to be yours: And so indeed, we continue the fault, we had sometimes Committed, and it becomes not only a step, but what is more, an obligation to the following Crime; that at length, we seem rather to perform a Duty, the name of a fault being lost, than to become Criminal.

But in the mean time, this matter in which I busie my self, may not be said to be unfit for your Knowledge, or to be disagreeing to the business of the Church, over which you most happily preside; For both those Epilepticks which are to be met with here precipitating themselves into the water or the fire, and those whose members variously Contracted and distorted with Spasms or Convulsions, and those whose whole Bodies so bent, that they could not stand upright, by and by, as if by Inspiration of the Devill, they are agitated with Stupendious leapings, and other wonderfull gesticulations. These I say, and many other Sick men whom I here every where describe, seem not much to differ from those whom we read of in the Evangelists, to be cured by our Lord Jesus Christ; and although such be to be cured however Consummationous and rebellious they are, the Physitian, however Skillfull he be, ought allways to Implore the help of the Heavenly Power, to be assisting to him, being above all the
Strength

The Epistle Dedicatory.

Strength of Medicines. Therefore and by right the Disease by the Ancients called Holy of the word *Theoria*, and the rest of our Pathology, as if it contained in it a certain Divinity, explicates the Disease to be cured no lesse with prayers and fastings than with Medicines, and therefore should desire greatly to call upon the Authority of Holy men, and to be helped by the Power of your Sanctity.

Besides it is no new thing that there should be an Entrance into the Church thorow the Spittle, for that it appears, our Saviour to have used almost this method, who would for the most part, that the health of the Soul, should take its beginning from the restored health of the Body. And truly, as the Stupid *Deliriums* of Melanchollicks, the Caninish madness, and others sprung from an infirm Brain, have driven some, both from the Communion of Saints, and from the Society of men, if these had been profligated by the help of our Art, it would not be dispair'd of, but that the men should not only, growing well, have left both at once their Diseases and Errors, but also should have become Wise.

It remains, that I Supplicate the Great God, that he will render to his Church, the peace he has happily given to the Common-wealth, that he may take away the darkness from the eyes of the miserable people, that he may withdraw the fury from their mindes, and for a pledge and advantage of so great a benefit, that he may long keep safe and in health, your Grace, the mighty Pillar, and Glory of the Reformed Religion, which is Cordially desired by

Your Graces most humble

and Devoted Servant,

T.W.

Of

Of Convulsive Diseases.

CHAPTER I.

Of Spasms or Convulsive Motions in Generall.

IN handling the Convulsive Distempers, many Physitians distinguish between the *Spasme* or *Convulsion*, and *Convulsive Motion*; by the first they understand a constant Contraction, whereby the member becomes stiff and inflexible; by the Second, swift motions, and Concussions, which, coming between, cease, and return alternately: But neither those who have observed these notes of difference, nor other Authors, have taken notice that they are continual: for that by the words *Spasme*, and *Convulsion*, they often designe a certain Spasmodick or Convulsive Affection; wherefore to distinguish it better, we will call the former distemper with *Cardan*, tetanon, a continual Convulsive Cramp, but the other *Spasm*, or, a *Convulsive motion in generall*.

But that the irregular Nature, and Causes of Convulsive motion, might more rightly have been made known, it should first have been declared, after what manner the regular motive function, is effected in an animated Body: but the more full Consideration of this, because it belongs to the Physiologie, or Reasoning of the Nature, of the Brain, and Nervous stock, it is deferred to another Discourse: For the present, we will signifie in a word, as much as shall serve for the elucidation of the matter proposed. That the animal Spirits are the next Instrument of regular motion, and that their Action, or moving force, consists only, in that they being more thickly heaped up together, in the motive part, and there spreading themselves in a more large space, they blow it up, and intumescie it, which for that reason, being contracted, as to its length, draws to it self the part hanging to it. In our description of the Nerves already published, we have shown this kind of motion to be twofold, to wit, Spontaneous, and meerly natural, the Instinct of this is derived from the Cerebel, but of that from the brain, but both through the pipes of the Nerves, as it were the channels, both to the muscles, and also to the fibres, interwoven with the membrains, and other motive parts of the *Parenchyma*, or Inwards; Lastly, in all these, the various actions are so expeditiously effected, which either natural necessity, or the rule of the will requires, by that only means, that there is an intimate Conjunction, and communication of Duty, and most swift Commerce, between the animal Spirits, which Constitute the *Hypostasis* of the sensitive Soul, within the foresaid parts, disposed, or fitted by a continued *Series*. But there is this notable difference between the motion of a muscle, and that performed by other parts; for in these, the action is most often circumscrib'd within the bounds of the motive body, so as its membranes only, or one part of the inward moves another, and consequently this is moved of its neighbour: But in the musculous stock, usually the moving part is placed in one member, and to be moved of another next it (although within some musculous part, as the Heart and *Diaphragma*, they properly for the most part move themselves only) hence the Membranes and Inwards, are said to have as it were an intestine, and vermicular Motion; such as wherever it is begun, the Spirits there more thickly gather together, and Spreading themselves forth, they first intumescie this part, then going forward another, and so farther, till at last they draw the hindermost parts, and by this means transfer an intumescation, and therefore a motion, from one place to another; almost after the same manner as worms, and other Creeping creatures make their progression. But to this motive function of the Membranes and Inwards, if it be frequent or undiscontinued, plenty of spirits are required, which notwithstanding execute their task calmly enough, without tumult or great force: And indeed it is to be observed, that the Animal Spirits, flow not more sparingly into the Membraneous Inwards, than into the Muscles; as it appears from the

How the regular Motion is Effected.

Its beginning twofold.

The Subject also twofold.

The Motion of
a Muscle is a
certain explo-
sion of the Spi-
rits.

more exquisite sense of those parts, and by the manifold insertion of Nerves within them, and the diversity of divarication, through the foldings and *fibres*, although in the mean time, the muscles are watered, with a more plentiful influx of Blood : But as to the motion, performed in the musculous stock, the heaping together, and rarefaction of the Spirits, through the whole joyniting of the motive part, suddenly, and at once unfolded, are performed with such force, and strength, as the attraction of the muscle, in its motive endeavour, may exceed the force of a pulley or windlace ; and when this force, only depends on the expansion or rarefaction of the Spirits, seated in the motive part, we can conceive it to be no otherwise, but that the Spirits so expanded or stretched forth, as it were fired, after the manner of gunpowder, to be exploded or thrown out. But we may suppose, that to the Spirituous Saline particles, of the spirits inhabiting the interwoven *fibres* in the muscle, other nitrous-sulphureous particles, of a diverse kind, do come, and grow intimately with them, from the arterous blood, flowing every where within the same *fibres* : Then as often as the particles of either kinde, as *Nitre* and *Sulphur* combined together, by reason of the instinct of motion brought through the nerves, are moved, as an inkindling of fire, forthwith on the other side bursting forth, or being exploded, they suddenly blow up the Muscle, and from thence cause a most strong drawing together : for indeed it seems to be ordained for this end, that the Muscles are inbrewed much more plentifully with the arterous blood, than the membranous inwards : to wit, that the Elastick coupling of the spirits, being consumed, and perpetually falling off, through the very often, and sometimes continual motion, might be by that means supplied, from the fresh sanguineous juice : in the mean time, that the spirits themselves, being supplied in a smaller quantity, through the small nerves, might even like old Soldiers continue longer in the same station, and follow their manifold coupling or labour. How else are labouring beasts supplied with a sufficient stock of spirits, for so much labour, whilst they exercise almost all their muscles, by a swift course for many howers, yea sometimes a whole day : or who can believe that a little handfull of spirits brought through the small branches of the wandring and Intercoastal pairs of the Nerves to the heart, can be able by their own strength to effect that its so strong and indiscontinued motion ? Indeed it seems, that of necessity there must come to them from the blood perpetually, auxilarie aid, and those afterwards to be allways exploded. For this reason certainly, the motive virtue, both of the Heart, and the rest of the Muscles, becomes more strong and Elastick, above any mechanick Organ : to wit, for as much, as the animal spirits, acting every where in the musculous stock, get to themselves an explosive *Copula*.

If any one shall be displeased at the word *Explosion*, not yet used in Philosophy or Medicine, so that this Spasmodick Pathologie, standing on this *basis*, may seem only *ignoti per ignotius explicatio*, an explication of unknown things by more unknown things ; it will be easy to shew the effect of this kinde of notion, and very many examples, and instances both concerning natural and artificial things ; from the Analogie of whose motions, in an animated body, both regularly and irregularly performed, most apt reasons are to be taken. For besides the mixtures of *Nitre* with *Sulphur*, with *Tartar*, and with *Antimony*, all which are fired with a thundring noise ; also *Aurum fulminans* or *fulminant Gold*, and a Composition of salt of *Tartar*, with *Nitre* and *Sulphur*, without any actual fire, being only thoroughly heated, are exploded with a vehement Crash ; also to this may be referred, many Liquors, which being mixed together, or poured upon some certain bodies, cause or stir up violent motions, and plainly Explosive : The spirit of *Nitre*, and the liquor of congeled *Antimony*, being powred on one another, or either of them thrown upon the filings of Iron, cause a great *Ebullition*, with heat and black smoke. It is commonly known, what heat or effervescency, and force plainly explosive, arise from fixed Salts melted together, and from acetous or sharp salt of every kind, mixed with one another : Nor is the effect of Explosion less seen, when a Liquor imbrued with a volatil Salt, as the spirit of Harts-horn, or of blood, is put to a saline, either fixed or acetous *Stagma*, or sulphurious *Nitre*, to wit, the particles being vehemently stricken one against another, leap up with a force, and on every side are carried forth, a great

great way; which without doubt, if they were restrained within the space of any body, as the *fibres* of a Muscle, they would suddenly intumescit it, and so would constitute an Instrument of Local motion. Concerning this thing, we have more fully discoursed already in our *Neurologie*, or Tract of the Nerves, and perchance we may yet publish the explication of this more fully and more accurately some other time.

In the mean time that this opinion may not be thought altogether new, and that I have exposed it as a childe of my own brain, that had no other Patron, I will here shew you the assertion of the Famous *Gassendus*, which as it openly favours this our Hypothesis, and in some sort gave an occasion of it, so perhaps it will give to it some Authority. 'Therefore this Rational man, weighing in his 'minde, how much that force or strength might be, with which, not only the 'Arm, or Thigh, but the whole animal Machine, is moved, govern'd, lifted up, 'and carryed up and down: He adds, Who can easily comprehend that small 'thing, whatsoever it is, within the body of an Elephant, whether we conceive 'it to be a soul, or spirit, or any other beginning of motion, that it should be 'able to agitate such a bulk, and to cause it to perform a swift, and regular dance? 'and so much the more, for that, when as that small thing within that body, no 'longer flourishes, there is need of so much outward strength, to remove it never 'so little from its place: but indeed, the same fiery nature of the soul, serves 'chiefly to this, which, although it be a very little flame, it is able to perform 'within the body, by its own mobility, the same thing in proportion, that a 'little flame of Gun-powder does in a Cannon: whilst that it not only drives 'forth the Bullet, with so much force, but also drives back the whole machine, 'with so great strength. But indeed he says as to the spirits, which (like exploded Gun-powder) cause the agitation, it is doubtfull, whether it be they, 'which come from the brain, or those in the little tendons as it were of kin to 'them or springing from them, that are thought to do it: But although either 'of them concur, yet they seem to be more presently destinated to this office, 'which are those of the same kin or off-spring in the Tendons. There needs no more, it is declared, that the motive function depends on the *Elastick Copula*, of the animal spirits, and its decision or abating. But from this being supposed, (which indeed we may suppose with very great probability) it easily follows, that the Convulsive motions proceed from the like cause: For whosoever shall consider the sudden puffings up, the violent and strong Contractions, in the members and affected parts, yea sometimes the most impetuous concussions, and violent throws of the whole body, can conceive no less, than that very many heaps of the animal spirits are exploded, or thrust out, even as lightning breaking forth from a Cloud. Further from hence it may be Argued, by a reciprocal Argument; that because the Spasmodick motions are explosive, that therefore the regular are also produced by the explosion of Spirits: But after what manner, and by what means, and from what causes, the animal spirits being exploded, or thrust forth; produce Spasmodick affections, shall be our present business, a little more largely; and plainly to demonstrate, however difficult, and abstruse the matter seems to be.

We will not here stand to recite many opinions of others, concerning the Nature, and causes of a Spasm, or Convulsion; that which was most common, and long famous among the Ancients, that this distemper was only produced from repletion or inanition, or from fullness or emptiness; (however, besides the authority of *Hipocrates*, for the establishing of this, an example is brought of a Skin, or the strings of Lutes, which are wont to be contracted, being either filled with a moist, or emptied by too dry an aire) easily falls of it self; because it seems to suppose (that which is credible to none by Experience; the fragility of a *Nerve*) to wit, that the *Nerves* themselves, after what manner soever *abbreviated*, and contracted, are able with a certain force, to draw to them the Muscles. If that it shall be said, that repletion or inanition, ought to be understood, in respect of the solid parts, which are wont to be drawn together; it may be observed to the contrary, when as the Muscles and Nervous stock, are very much watered with a watery humour, as in an *Anasarca*, or are plainly destitute of the same, as in the Consumption, or *Mirasmus*; yet no Convulsive motions are for that reason excited: among the moderns, very many have determined,

The Conjoint Cause of Spasms.

Not repletion or fullness or inanition or Emptiness.

ned, irritation of the Nervous parts, to be the cause of Convulsion; taking their Conjecture from thence as I suppose, for that by ocular inspection it appears from the Vellication it self, and by the only touch of the Nerves, that spasms are induced: And indeed we have clearly observ'd, in the dissection of a living whelp, that the knife being put upon the naked ends of the spinal Nerves, presently both themselves, and the Bodies of the Muscles, in which they were inserted, were hauled: neither is it unusual, that spasms are excited almost in every man, by the punctures of the Nerves and Tendons. I remember by reason of an Ulcer, in the Arms of a certain man, that the Tendons of the Muscles were laid open, which when touch'd by the Surgions Instrument, caused in the Patient a certain rigor, through his whole body, and forthwith a Concussion arising, made him to quake for a good space. But in truth, albeit we grant the irritations of the Nervous parts, not seldom to serve the turn of the evident Cause, and further that sometimes this solitary Cause, produces more light and transient spasms; nevertheless, that the more grievous paroxysms of this Disease, and their frequent repetitions by turns, may be duly unfolded, it behoves us to investigate, or search out other, and deeper Causes, to wit, the Conjunct and procatartick Cause.

Forasmuch, as spasms never happen but in a living Body, where the Nervous parts are blown up, and grow turgid with the animal Spirit, we may readily Conjecture that those animal Spirits themselves, are, as in regular motion, so also in the Convulsive, the next Instrument of Action: to wit, so long as they are imbued, with a fit and moderate explosive *Copula*, and are moved to that striking forth, only by the Command of the Appetite, or instinct of Nature, they bring forth motions altogether regular; but if the same Spirits get to themselves an heterogeneous *Copula*, and too much Elastick, or if they are snatched into their Actions, more impetuously and vehemently than they should be; they even like unbridled Horses, pricked forward with Spurs, leap forth inordinately or throw off, or explode violently their *Copula*, although genuine and natural: and so they carry away the containing parts, as it were a Chariot tied to them, together with themselves, with a fierce and perverse motion.

There is a double Cause and two kinds of Spasms. Irritation.

A preternatural explosive Copula.

When therefore as aforesaid, the Convulsive motions are chiefly stired up for two Causes, hence, as many *Species* of them are ordained. For first, it happens that a Convulsion is induced without a procatartick Cause, or heterogeneous *Copula*, first acquired only from a solitary evident Cause: For so a vehement passion, impressed on the brain, a dissolution of the parts, hapning somewhere in the Nervous stock, a spasmodick passion is suddenly brought upon some, whose brain and Nerves are of a more weak Constitution: for that the animal spirits do trouble the containing parts, the impropportionate Object flying from them, and by striking vehemently their *Copula*, though very agreeing it blows them up, and so they pull others annexed to them: Spasms being after this manner excited, because the natural *Copula* of the spirits in them, is stricken more vehemently, they are after a manner explosive, which notwithstanding, quickly leave off, and very often pass away with moving of the viscera, or Members; only with a trembling, and some horror, into a fainting of the spirits. But Secondly, Convulsions, whose paroxysms are more grievous and stay longer, or are oftener repeated, seem altogether to depend on a procatartick Cause, or a previous disposition, and to arise from some other Conjunct Cause, besides Irritation. And therefore in this Case we suppose, that the heterogeneous, and greatly explosive particles, do increase with the spirits, acting in this or that region of the Body: then from this wicked Combination, and restless Collision of this kinde of matter, and the Spirits, frequent and vehement explosions being brought forth, the spasmodick Paroxysms are induced.

But besides the Elastick *Copula*, which every where happens to the Spirits, from the arterous Blood, and from whose orderly explosion, the motive force is performed, according to the Book of the Appetite, or instinct of Nature, in all the Nervous parts; (as we have elsewhere declared) also sometimes other kinde of little bodys, of a fierce nature, or rather like *Gun-powder* or *Nitre*, come to the Spirits, and intimately adhere to them, when frequent and suddain divorces of this matter, from the Embraces of the Spirits, happen from the mutual striking together of the particles, the containing Bodys are variously blown up

up, and so are thrown into Convulsive motions. In truth, as often as the Spasmodick Affection becomes habitual, that the Convulsive Paroxysms arise not rarely on their own accord, and without any evident cause, but still on every light occasion; the procatartick Cause of such a disease, consist in the evill disposition, of such a sort of animal Spirits: For neither is the Serous filth, or other less sharp humours, although deposited in the very ventricles of the Brain, or about the origine of the nerves, sufficient to stir up such a sickness: For that I have seen in the heads of dead people, oftentimes the middle part of the brain, and the very beginnings of the Nerves, wholly covered with a limpid water, who, whilst they were alive, had neither the Epilepsie, nor Convulsive Motions: But to the producing or these motions, very active Bodys are required, such as are Saline, and Sulphureous, which being combined with the Spirits, and then on a sudden breaking from them, they imitate the combinations, and violent explosions, of particular mineralls. For indeed, if in regular and ordinary motion (as we have intimated) the Muscles cannot get a motive force, and elustick strength, unless a certain explosion of the animal Spirits be supposed, certainly much more lawfully may we assert, that, epileptick fits, and other admirable Convulsions, which still happen to be excited, complications of the same Spirits, with other very fixe particles, and vehement elisions, or strikings of these, one against another, are required. But, as to this kind of Spasmodic *Copula*, because it differs from the natural and ordinary, which we have elsewhere shewn to be in regular motion, and to be supplied from the blood; it behooves us to inquire, from whence it comes, and by what means, and in what places, it is wont to get to the Spirits.

As to the first, it is to be observed, that Spasmodick explosions do every way happen, in the muscles, to which only they are limited, which effect the regular motion, but also in the membranes, to wit, the ventricle, mesenterie, and other parts almost without blood: besides, that the explosions themselves, in the Convulsive Affection, though they are excited contrary to the will of the Appetite, and the manner of Nature, are far more vehement, and do longer continue, than in the regular motion: out of which it seems to be manifest, that the Explosive Spasmodick Copula, doth come from some other place, than the Effectrice of Legular motion: And indeed, it is probable, that, that flows not, as this, from the arterous blood, running every where among the musculous fibres, but descends from the Braine, with the Liquore watering the Nerves, and so is heaped up, about their beginnings, middle, processes, enfoldings, and Extremities, as it were the mine of the Convulsive disease. Indeed nothing appears more evident, than that the Spasmodick Disease, doth most often arise, by reason of the evill first fixed in the Brain, and from thence is transmitted, into various parts of the Nervous System: for it happens from hence, that a vehement Passion, as of fear, or Anger, or of Sadness of spirit, affecting the inhabitants of the *Encephalon*, the passion called Hysteric, and Hypochondiac, doth so often arise: Further, that in the evill Crises of Feavours, when the adust recrements of the blood, are transfer'd into the head, Convulsions do generally succeed. Moreover, and this is the reason, why the Vertigo, the inflation of the head, torper of the minde, and other accidents of the Supreme Region, are wont to be the *proæmium*, of Spasmes presently following, in the Inwards, and not seldom, in the whole Body. Wherefore it is not to be doubted, but that the heterogeneous, and explosive particles, are instilled from the Blood, together with the nervous juice, into the Brain; which afterwards being thrust forth, into the nervous stock, do there grow to the Spirits, and with them bring on a Convulsive disposition. In truth, the Spasmodick distempers, which are either universal, or at least occupie many parts of the body at once, arise for the most part, by this only means. But in the mean time, we will not deny, but that particular Spasms, which contain themselves within Certain places, the dead being no ways affected, are induced sometimes by other means. For if the nerves imbibe their humour from either end, to wit, the root, and the extream fragments, (which both the learned *Glisson* maintains to be most likely, and by us is shewed in our Neurologie, not without great probabillity) it may be from hence inferr'd, that the Spasmodick particles are brought inwardly, not only from the beginning of the Nerves, but somewhat also by their extremities: Therefore that perhaps appears clear and

The explosive
Spasmodic
Copula not
immediatly
from the Blood
but from the
Brain.

Sometimes received from the ends of the Nerves.

plain enough, that from the spleen being evilly affected, Spasms arising about its region, do not seldom affect the *Hypochondria* and *Præcordia*. I have known some, from a tumour or ulcer existing in the Mesenterie, womb, and other inwards, were wont to have Convulsions, both in the grieved part, and also all about it; the reason of which seems to be no other, than that the heterogeneous particles being more plentifully heaped up, in the affected place, Creeping also into the nervous fibres, planted nigh thereunto, supply them with matter for Convulsive motions like to fired gunpowder: But indeed, Spasms arising from such a cause, are not wont to diffuse themselves far about, nor always to ascend to the Head.

The more remote Causes of Spasms.

These things being thus premised, concerning the inward and next Cause of the Spasmodic Distemper, which we affirm to arise chiefly, and most often, from the head it self, and in some respect also from the extremities of the Nerves, it now remains, that we more particularly declare, the Various remoter Causes in either Kinde, and the manifold provision of this disease. The Convulsive Disease therefore, for the most part, takes its original from the head: to wit; as often as the heterogeneous and explosive particles, being diffused from the blood into the Brain, or its medullarie Appendix, are afterwards derived to the nervous stock, and there grow together with the Spirits: But this happens to come to pass from various causes: for there are very many ways and means, whereby the morbifick matter is admitted into the head, and very many also, whereby it is deduced into this, or that region of the nervous System; and according to the various translations of this kind of morbifick matter, the divers kinds of Convulsive motions are constituted.

The morbifick matter is heaped up within the Head, by the default both of the blood sending it.

Therefore, that the Heterogeneous and Spasmodick particles are admitted into the Encephalon, it is to be imputed to the fault, both of the blood sending, and of the Brain receiving it.

1. When the Blood powrs upon the Head the morbifick matter, either all its whole mass is depraved, as it frequently happens in malignant feavours, also in the Scorbutick, cacochymick, and chiefly in an originally corrupt Distemper; or the Blood of it self innocent and incorrupt, receives elsewhere malignant little bodys, and afterwards fixes them on the brain, so in great impurities of the Inwards, and chiefly when any parts are affected with an Inflammation, or virulent ulcer, or hurtfull ferment, for from such mines the taint of the disease, the noxious particles bubble up into the blood, and afterwards, in its passage, are laid up in the Brain: So, by reason that the spleen, womb, and other Inwards, being evilly affected, Convulsive Diseases are excited, which notwithstanding, depend more immediatly upon the Brain, receiving the corruption of those parts, through the commerce of the Blood.

And also of the brain receiving it.

The evil disposition of the brain is either hereditary

Or acquired.

2. But in the second place, the Blood however vitious it should be, and impregnated with the morbid seed, it could not easily leave its Infection on the head, unless there were some fault in the Constitution of the brain, and its Appendix; as long as these parts are well made, and are full of vigour, they defend themselves, and what belongs to them, and the doors being shut, they admit nothing but an unmixt spirituous Liquour, destinated for their use: but if either the passages, and pores of the Brain are too lax, or the door-keeping Spirits leave or are called off from their watches, an heterogeneous and morific matter, creeps in together with the nervous juice, and unfolds its malignity, in the animal government. As to the evil disposition of the Brain it self, it is sometimes hereditary: So those sprung from parents obnoxious to the Epilepsie, or Convulsions, are themselves for the most part prone to the same Distempers: and indeed, the Constitution of the brain, may several ways become vitious from the birth: for either its temperature is more moist, or more dry than it should be, or it may be faulty by the excess, or defect of either Quallity. Sometimes the pores are more lax, or its consistency is too soft, or too hard: and also the Conformation of the parts of the Brain, and its Appendix, may be after an undue manner; But sometimes, the disposition of the Brain and Nerves, originally whole, and firm, is vitiated by accident, and acquires a morbid inclination: long Intemperance may enervate these parts: as also malignant feavours, and chronical Diseases, very much debilitate them: besides outward accidents, as the excess of heat or cold, an ulcer or a blow oftentimes perverts their Crases, and renders them more incident

dent to the impressions of Diseases. But as to the Constitution or irregularities of the animal Spirits, by reason of which, the heterogeneous and Spasmodick particles, enter the brain without any repulse, and more easily cleave to it; it is to be observed, that the animal Spirits are in some more tender, and easily dissipable, from their very birth; so that indeed, they are not able to suffer any thing very strong or vehement, to be brought to the sense or Imagination, but strait they fly into confusions: For this Reason, women more than men, and some of them more than others, are obnoxious to the passions called Histerick. Further, sometimes a violent Passion, impresses on the spirits, though moderately firm, this kind of dissipation and inordination, so that afterwards they are able to suffer nothing strongly, or to resist any injurie: So it often happens, that morbid impressions are affixed on the animal *regimen*, by sudden fear, or great sadness, which can hardly ever after be blotted out: for from hence women often contract first the Diseases named the *Mother*, or from the *Womb*, and men the *hypochondriack*, and are for the most part still subject to them.

From these things it appears, after what manner, and for what Causes, the Spasmodick Matter is wont to be admitted into the Head: now let us see next, what is done with it afterwards; if that this matter brought to the Brain, induces the Convulsive distempers, either not always, or not altogether, after the same manner.

1. It sometimes happens, that the heterogeneous and explosive Particles, are admitted into the Brain, which notwithstanding are again exterminated, without any great hurt, and before they enter into the nervous stock: for that the veins and Lympheducts, or water-carrying Vessels, often sup up what is superfluous, and an enemy to the animal dominion, and convey it forth of doors, or dispose of it into Emunctuaries, or Sinks. Whilst such a matter is for a little while agitated in the brain, its particles being affixed to some of its Spirits, and at length striking against them, cause the *Vertigo*, and the swimming in the head; but because they enter not into the passages of the nerves, Spasmodick Distempers do not follow.

2. When the morbidick matter is admitted within the Head, and not presently from thence sent back, oftentimes it produces not its evil; till it is inserted into the stock of the Nerves; for the animal Spirits within the Brain, being as yet strong, and having got a more free space, they evade the embraces of every heterogeneous *Copula*; which indeed they are not able to do, within the strait channells of the nerves: Besides, the morbidick matter it self, if it cannot be sent away out of the Brain by the excretory vessels, it is by and by sent forth to the System of the nerves as the more ignoble part: but if in spite of the force of the superiour faculties, such a matter stays long within the brain, it much infects the Spirits that inhabit it, and induces the *Epilepsie*, as shall be more particularly shewed hereafter: but more often, the hurtfull matter is thrown on the nervous stock, from the brain, without much harm to it, but this happens to come to pass, not always after the same way.

For truly, the heterogeneous Particles, being mixed with the nervous Liquor, and fallen towards the beginnings of the Nerves, do not indifferently enter all of them together, or these, or those, as chance shall guide them, but they are directed to the passages of some before others, and that not without some Reason. For we observe, that the Convulsive Symptoms, do choose for the most part one place in children, another in riper years, and a different one in more tender, than in the more robust.

In children, who are not yet accustomed to the Affections of the Heart, and exercise of the outward members (whereby the morbidick cause may be further carried from the brain) the Spasmodick matter runs more often into those nearest Nerves, *viz.* the third, fifth, and sixth pares; wherefore, their faces and mouths, and those parts, are chiefly handled: and it is rare and unusual for them, to have their *viscera*, and *præcordia*, lifted up, or affected, with an inordinate motion, as in those of riper years: on the contrary, in men of more advanced years, by its approach to the intercostals, and the Nerves of the wandering pare, it being more open to those of the spinal marrow, which those nerves respect are wont to be more frequently pulled: but yet with this difference, that in the more tender, and those who are very delicate, and subject to passions, and who by reason of the

2. How the morbidick matter being admitted within the head is disposed.

Sometimes it is carried back again from the brain.

Sometimes it is thrust out into the nervous stock.

Remaining in the brain causes the falling-sickness.

The spasmodic matter being fallen on the nervous stock.

Affect the foreparts of the Nerves in Children.

Otherwise in those of riper years.

the passions of the minde, have very often their *præcordia* and *viscera* disturbed, the Spasmodick matter, more readily enters the more open passages of the interior Nerves, and therefore, they are rendered more obnoxious to Spasmes, stirred up in the *Abdomen* and the *Thorax*: for hence it is that women are molested with the passions called Hysterical, and some men with the *hypocondriack*; as shall be more largely declared hereafter, when we come to treat particularly of these Distempers.

After what manner it disturbs the spirits, whilst it stays near the beginnings of the Nerves, or being fallen more deeply into their passages.

The spirits enter into explosions, by reason of plenitude or irritation.

The Spasmodic matter causes Convulsions either continued or periodical or by fits.

When the Spasmodic matter falls upon the heads of some nerves, or remaining there, it creates only a giddiness, and lighter *Spasmes*, and leapings of those parts, to which these Nerves belong, or being slid down more deeply into the pipes of the Nerves it brings forth more cruel Convulsive Paroxysms: but the same being dilated, into the nervous processes is disposed through one or more of the branches of the stock, or Trunk, sometimes all, and sometimes only those more open than the rest, and by degrees cleave to the Spirits; both within those Nerves, as also to those planted within the hanging *Fibres*: so that it is after the same manner, and there is the like preparation in the disposition to Convulsive *Paroxysms*, as if grains of Gunpowder were laid in a long train to be fired successively: The Spirits after this manner imbred with an heterogeneous *Copula*, are lodged within the *Fibres*, interwoven with the membranes, and Muscles, but chiefly within the nervous foldings; and when they grieved with too great plenitude, or troubled on any other occasion, are compelled to shake off their *Copula*, the particles striking and leaping one against another, hugely blow up the containing parts; and so excite a motive force, contrary to the commands and Laws of the Appetite, and Nature: Besides, the Spirits once stirred up, to the performing Convulsive motions, begin their explosions, from the one or the other extremity, of the nervous System, but for the most part at the end. But they who are first exploded, snatch or take with them their neighbours, also prædisposed, like a fiery train; and so they propagate the begun affection, with a long, continued series of Spasms, from one end to the other: For a convulsion begun in the bottom of the belly, or at the foot, or hand, creeps by degrees to the upper parts; and for the most part to the head it self: and the same Distemper, when it begins in the brain, (as in the Epilepsie) is derived in like manner thence downwards, to the remote Viscera, and also to the exterior members and Limbs.

The morbidick matter, flowing in the heads of the nerves, produces divers kinds of convulsions, according to their various plenty and dispensation; for first of all, it is to be observed, that the whole passages of the nervous System, or of some of its parts, through the abundant, and exuberant matter, are sometimes possessed; so that the animal Spirits, both flowing in, and there implanted, being full of an heterogeneous *Copula*, and a perpetual supplement of it, are urged into continual Spasms. I have known some, who have had all the muscles and tendons through their whole body, afflicted with Contractions and leapings without intermission: I have known others whose thighs, arms, and other members, were perpetually forced into various bendings, and distortions: and also others I have seen, who of necessity were compelled to leap and run up and down, and to beat the ground with their feet, and hands; and if they did it not, they fell into cruel Convulsions of the *Viscera* and *Præcordia*: 2. If the explosive and heterogeneous Particles, be combined with the Spirits in a lesser plenty, they stick to them without tumult or perturbation, untill after some time, both Particles leaping again one from another, and from their striking one another, raise up Convulsive paroxysms; which sort of Paroxysms are periodical, and are repeated exactly at certain hours; which happens by reason of the morbidick matters, being daily poured upon the nervous stock, with an equal dimension, and therefore about the same space of time, it is also daily heaped up to an explosive plenitude; or they are wandring, and uncertain, in others, for that the heterogeneous particles, are poured in with a lesser company, and so arise not to an explosive fullness, under a long time; when in the mean time, the more full heaping of them together, and their explosion, are wont to happen sometimes more often, and sometimes more seldom, by reason of several occasions, or evident causes: hence it comes to pass, that the Spasmodic Distemper is sometimes altogether attributed to the evident cause, when indeed, if a more remote convulsive cause had not gone before, such a cause had stir'd up none.

Therefore,

Therefore, that we may say something of the evident causes of Convulsions, we have already observ'd, if they be more vehement, and happen to a weak and tender constitution of Brain, and nervous stock, they are sometimes solitary, or of themselves cause convulsive passions: but as often as the Spasmodick Distemper is heavier, and being made habitual is wont to return oftener, though the evident Cause be manifest, and bears the blame of the effect, nevertheless it is to be suspected, that a procatartick, or more remote cause exists, and is the more strong efficient, though it lies hid within: for unless the Spirits are imbued with an heterogeneous *Copula*, they would not be so easily; nor so often, driven into involuntary, and præternatural Explosions.

The Evident causes of Spasms.

We meet with a double order or *Classes* of Evident causes; for either they are of that sort which increases the procatartick or more remote, and brings it sooner to an explosive fullness, as are an ill manner of living, and errors in the six *non-naturals*, which by infecting the blood, and nervous juice, heap up to a Saturation, in greater plenty, on the Spirits heterogeneous particles, and by that means do the sooner procure Spasmodick accessions. Or 2dly, the evident cause is said to be, whatever stirs and irritates suddenly the spirits, that they presently fall into explosions, and whatever it be, that causes them to strike off their *Copula*, and of this sort there are very many accidents, that provoke the spirits, planted now within the Head, and now within the nervous System, to convulsive motions by a divers instinct (as is wont in the regular motions) which motions are either direct; or reflected.

The Evident Cause twofold viz. Filling and Irritating.

The irritating Cause, stirs up Spasms, direct; or reflected.

1. Of the former kinde chiefly are violent perturbations of the minde, where with the spirits of the brain being agitated and confused; they excite others lying within the nervous stock; and often prædisposed, to irregular explosions, so a vehement fear, anger, or sadness, do not only introduce epileptical and hysterical fits, to those that are disturbed in their health, but sometimes cause to divers others, palpitation, and trembling of the heart, and also horrid convulsions of the members and Limbs. 2. As to the other kinde of evident cause, to wit, whereby Spasms are excited by a reflected Act, this indeed comes to pass not unfrequently, as often as any heavy trouble, with an irritation of the *fibres* and spirits, happens any where to the nervous stock: for that this trouble being by and by communicated, to the chief fountains of the Spirits, to wit, the brain or Cerebellum, from thence inordinate and violent motions, against the will of the minde, that is convulsive, being begun, they are returned back, for so either worms, phisick, or sharp humours, cruelly hauling the coats of the Intestines, cause spasms in those parts, and not seldom in the outward members.

So much for the several kinds of causes, the conjunct, procatartick, and evident, whereby convulsive Diseases, becoming habitual, and are wont to be repeated with more grievous Paroxysms, do arise: But as we have assigned another species of this Disease, where the Paroxysms depend on an evident solitary cause, or at most only from irritation, the Spirits being not yet præoccupied with an explosive *Copula*: it is now next to be inquired into, by what, and how many ways, this may come to pass. Concerning this in general, it is affirmed, that the Spasmodick fits produced by mere irritation are either lighter and quickly passing away, or more grievous and not seldom deadly, as when poyson is taken, or when they come upon an overpurging medicine. Moreover it is noted, when the morbidick, or irritative matter falls upon the tales themselves, or the foldings of the nerves, that it also not rarely becomes explosive; and so Spasms produced also from mere irritation (as we have already noted) are certain explosions; these being thus premised, we will dispatch the business in hand.

The irritating Cause distinguished, as to the places affected, as to the subjects.

The irritation of the Nervous parts, which is wont to cause convulsive motions, happens in various places, and from various matters, which are incongruous and inimical to the spirits, and *fibres*. As to the things, enemies to the Nature of the spirits; you may observe, besides poysons, and the excess of tangible qualities, which are inflicted from without; many things which are begot within us, viz. the various recrements of the blood, and nervous juice, feverish taints, præternatural salt, or sulphureous humours, yea worms, the stone, with many other things, to be infestous to the nervous stock, and ordinarily to stir up Spasmodick irritations. As to the places affected, or the seat of the irritative matter, although this brings hurt in any part of the nervous System, yet for the most part, it is

The places affected, are the beginnings, the extremities, and the middle processes, and foldings, of the Nerves.

wont

wont to become most infestous, when it is fixed near the beginnings, or the ends of the nervous System. or about the middle processes of the Nerves, and especially in their foldings: Besides, such a matter, which irritating the Spirits, is wont to have the place of an Evident Cause, doth not feldome become, as we hinted but now, the means of a more remote cause, forasmuch as the heterogeneous particles, being sent from it, enter into the nervous *fibres*, and being combined with the Spirits, renders them more apt and ready to be exploded.

How the irritating Cause affects the origine of the Nerves.

1. Therefore, it sometimes happens, that malignant humours, and infestous to the nervous stock, being poured out from the blood, on the region of the brain, and from thence dilated to the hinder region of the Head, do fall upon the *origine* of the nerves; where, if the little skin, which cloathes the oblong pith, be broken, they fall into the naked trunks of the nerves, and enter deeply into their *fibres*; wherefore indeed, *Convulsive motions* arise, not only in the neighbouring parts of the head, but sometimes in very remote, and not rarely in the whole nervous System: This is generally observ'd, in evill *Crisis* of feavours, the morbi-fick matter being translated to the head; also in cephalic Distempers, being brought to the worst and deadly state. Truly, when I have opened the heads of those, who have dyed by this means, I found in all of them, the hinder Region of the oblong pith, immers'd with a sharp, and salt *Serum*.

How the extremities of the Nerves.

2. As the interior extremity, or original of the System, so not rarely the exterior, or the end, from a vellication or hawling there made, begets Spasms, or Convulsive motions, and transfers them on every side: that this is done ordinarily in the outward members, the prickings of the tendons, and Nerves, do testifie. No less are Spasms wont to be excited every way about, from a vellication or pulling, made in the *Viscera*, when at any time Medicines, or sharp humours, also worms lying in the Ventricle or Intestines, pull the membranous part, and so impress a troublesome sense on the chief sensories; presently from thence, by reason of the firing of the spirits, *Convulsive motions* torment now the affected parts, and now indifferently any other parts: for oftentimes Spasms, from the more grievous hurt of some Inwards, do not only imploy the affected parts, and their neighbours, but also the Muscles of the face and mouth, and are likewise transfer'd to the exterior members. The stone impacted in the Uriters, causes not only cruel Contractions in that passage, but in all its neighbourhood. Moreover, some hysterick and other hypochondriac Symtoms, are sometimes induced by this means, forasmuch, as by a vellication made in the membranes of some *Viscera*, thence the Spasm is returned back.

How the middle processes and foldings.

3. The irritative matter, which is wont to be the Evident Cause of Spasms, sometimes occupies the middle processes of the nerves; and therefore the parts, sometimes above, sometimes beneath its seat, are incited to convulsive motions: This appears plain enough in the foldings of the Nerves; for when the sharp recrements of the nervous juice, are laid up in them, they do not rarely create Spasms, through the whole neighbourhood: by this means, the Collick or Hysterick Distemper, is often seen to be begot or excited, there being no fault in those Inwards, only from the humours, deposited in the foldings of the mesenterie, as we will shew hereafter, when we come to treat of those particular Distempers. In like manner, by reason that the ganglioform foldings, being stopped up with a sharp and irritative humour, perfocation or choaking in the Throat, and various Contractions of the *Præcordia* are caused. Besides, Spasmodick Distempers do not feldom depend, upon a sharp humour within the whole trunks of the nerves, and filling the passages of the nervous Bodys. We have seen some troubled with admirable, and perpetual Convulsions, so that they have been forced (as we have already mentioned) to run about, to leap, to fling about, and distort their members, to strike the ground with their feet and hands, and to exercise other strange gestures, even as if they had been bewitch'd; the genuine Cause of which kinde of passion, seems to consist in this, that the Juice watering the nervous stock, being most sharp like stygian water, and being become degenerate from its due *Crisis*, doth irritate continually, and as it were possess with a certain madness, the Spirits therein flowing, and implanted.

The difference of Spasms in respect of their origine.

From these things, which we have discoursed, about the various causes of Convulsions, their manifold *Species* and differences are made manifest: For first, we have made known, that Spasmodick Passions are most often derived, in respect of their

their *origine*, for the head, being affected; or the morbid matter, flowing into the beginnings of the Nerves: yet sometimes, though more rarely, they depend upon such a matter, Creeping into the extremities of the nerves.

2. As to the production of the Disease and symptoms, we observe the same sometimes to be produced, from a solitary evident Cause, as a sudden and vehement Passion: but indeed more often, to require a more remote, or procatartic cause, or prævious disposition: moreover, the causes sometimes so to interfere, that the procatartick, also may supply the place of the evident cause; and also, on the contrary, that this may serve in the place of the other. *Of their Causes*

3. As to the extension of the Disease, the Convulsive Distemper may be distinguished into *Universal*, because the Spirits actuating the whole nervous System almost, and the *Encephalon* it self, are successively exploded; and *Particular*, in which the Spirits, within some private Region of the Animal Kingome, are disturbed.

1. The former is meant, when the animal Spirits are irritated, within their first fountains, to wit, the pith of the brain, and cerebell, from whence their violent explosions happen; wherefore every internal function of the soul, to wit, the sense and Imagination is obscured, and its exterior locomotive faculty perverted: This kind of universal Spasmodick Distemper, in which, besides the spasms of the Limbs and *Viscera*, the interior powers of the Soul suffer an Eclipse, is again twofold: to wit, either *primarie*, which begins at the Head, and arises, forasmuch as the Spirits inhabiting that place, being imbued with nitro-sulphureous particles, are first exploded, and their inkindling snatches or takes hold of the rest, flowing in both the medulary and nervous *Appendix*, and there stirs up Convulsive explosions, as may be discerned in the Epilepsie. *Of the extent of the disease.*

2. Or this universal passion, causing Insensibility is Secondary, to wit, which being begun somewhere in the nervous stock, from thence, plenty of spirits being successively affected, becoming like the undulation or moving of waters, is at length carried to the head it self: this often happens in paroxisms called hysterical, in which, by reason of the Spasm begun at first in the bottom of the belly, or some intumescency or rising up in the *Abdomen*, then, the same spreading higher, with the same effect, through the pipes of the Nerves, the Ventricle, and by and by the *Præcordia* are drawn together, and at length, the Spasm forceably rushing to the Head, the patients fall down, and all Knowledge is taken from them, and lastly, the Disease being reflected into other nerves, Convulsive motions of the exterior members succeed.

2. But as to the particular Spasm, in whose fit the sick continue well in minde, this Indeed is distinguished into various differences. As to the seat of the matter, which happens about the beginnings, extremities, or middle processes of the Nerves (as we have shewn) there arises a difference: For even as this morbidick matter, besieging the beginnings of the nerves, is fixed about the head, middle, or end of the oblong pith, it therefore happeneth, that sometimes only the parts of the face or mouth, sometimes the *Viscera* of the lower, or middle Belly, and again sometimes chiefly the outward limbs, are hauled together.

Further, a Convulsion, as to the duration of the fit, and its magnitude, uses to be distinguished, into a continual, and Intermitting: The former, as we have already hinted, is called *Tenasmus*, or a permanent Contraction, as when one part, or more, being Contracted or distorted with a constant stretching, are detained for some time in the same præternatural posture; so, when the muscles, or a member, suppose the eye, Lipps, Cheeks, are distorted from their right position, nor cannot easily be presently reduced: the cause of which is sometimes a resolution, or Palsie, in some other muscles, which when they are loosened, the opposite do too strongly Act, and draw forceably the whole part, towards themselves, which ought to stand, as it were betwixt them, in an equall balance: but sometimes, such a permanent contraction, is excited, by reason of the tendons being stopped with an impacted serous humour, which become for that cause stiff: This Kinde of Distemper becoms very familiar in the Scurvy, that the sick sometimes are not able to extend any member or Joynt, but they are contracted round like a globe. Sometimes the Tendons in the back by reason of such a course of humour, draw the bones out of their due situation, and cause a gibbousness, or bending out of the Body. The *Tenasmus* is wont to be distinguished into *universal*.

verfal, of which there are three Kinds, to wit, *Tension* forward, *Tension* backwards, and *Tenasmus* properly so called; and Peculiar or particular, which chiefly respects some certain member or joynt: we will speak of these distinctly hereafter.

2. The intermitting Convulsion; is either short and momentary, which is acted by frequent turns, and as it were by little leaps, as is to be observed in the quaking and shakings of the Tendons in horror, which are to be distinguished between, with a frequent alternation of motion and rest: or the leapings of the Spasms, and their intervals, are drawn out longer: So it is usual, for Convulsive paroxysms, when they are repeated, to endure for some time, and to leave off again; but such periods are now certain, or come to certain set hours, now rare, and incertain, and happen after a divers manner, and as various occasions are given. There are other differences of this distemper, which will be better illustrated hereafter, when we shall speak particularly of each kinde of Convulsions.

CHAPTER II.

Of the Epilepsie.

Thus far we have treated, of the Nature, Causes, and differences of Fits, or Convulsions in general according to a clean, new, and unusual *Hypothesis*, but (as I think) agreeable enough with Reason: our next business is, to explain particularly the chief kindes of that Distemper; amongst which the *Epilepsie* easily deserves the preheminance, and the Consideration of it ought to proceed, by a certain right of method and order; for that this Disease, having as it were got a large Empire, in the humane body, exercises its Tyrannie, not only in the whole *Encephalon*, but for the most part, in all the parts of the nervous Sistem at once: wherefore by the Ancients, it was called *Morbus Herculeus*, or the *Herculean Disease*, from the Cruelty of the distemper, and from the manner of the violent fits, as if sent, as it were by some Divinity, being so amazing, *morbus Sacër*, or, the holy Disease, to which may be added, the Conjecture of a certain Divine of our own Country, of no small note, to wit, that many, who were taken to be *Demoniacks*, or possessed with the devill in the New Testament, were only Epilepticks, and that they called the cure of this Disease by our Saviour Jesus Christ, an ejection or exorcism of the evill Spirit: In truth, in this Distemper, no marks at all, of the morbidick matter appears, or are so very obscure, that we may have deservedly suspected it, to be an inspiration of an evill Spirit, at least it is probably, that as often as the Devill is permitted to afflict miserable Mortals, with his delusions, he is not able to draw more Cruel Arrows, from any other quiver, or to shew miracles by any better witch, than by the assaults of this monstrous Disease.

As the Symptoms of the Epilepsie are very Stupendious, so their Causes, and the formal Reason of the Disease it self, are most difficult to be unfolded. For indeed, the business is variously controverted among authors, both concerning the part Affected, and also the manner of its being affected: many place its seat in the Brain, or its Ventricles, others in the meninges, or thin skins enwrapping the Brain, and some again in the middle, or lowest belly, but by what right shall be inquired into anon: In the meantime, laying aside the opinions of others, that the true speculation of this Disease may be found out, by the clew of right reasoning, we will first of all endeavour to give you its description, together with the whole sense of its *Phænomenas*. Secondly, these things being rightly weighed, to finde out the subject of the disease, and its chiefly affected parts. Thirdly and lastly, to add the means and manner. whereby this disease is begotten, with the true Causes of its Symptoms.

The description
of the Epilepsie,
or the
history of the
Disease.

In the first place, As to the Idea of the Disease, the Epileptick Fit or assault, seems to be only an universal, and more cruel Convulsion, to wit, in which the Spirits inhabiting the Brain, being first irregularly moved, and as it were confused, all the rest, dwelling in both the medulary, and nervous appendix of the *Encephalon*,

encephalon, begin at once Convulsive motions, or inordinate contractions, and continue them for some space, with frequent leapings or palpitations: The accession of the disease come upon them at unawares, and oppresses the sick, not the least thinking of it, and in the twink of an Eye, casts them on the ground, deprived of sense and understanding; for that they do not only fall, but are flung down with a certain force, so that oft times the part first stricken against the Earth, or other adjacent Bodies, is hurt with a bruise or wound; being last done, there comes upon them a gnashing of Teeth, with a foam at the mouth also, oftentimes the shaking of the head, and a frequent knocking it against the ground, the armes and thighs, yea, the hinder part of the neck, and back, either become presently flit, or else they are distorted hither and thither, with various bendings; some Cruelly beat their breasts, others strongly thrust out their armes and thighs, and fling them, and sometimes the whole Body, impetuously here and there; many have their *precordia*, and *hypochondria*, and also all their lower belly swelled, and blown up very much: after some time, sometimes shorter, sometimes longer, these Symptoms, the Tragedy being as it were acted, cease, on a sudden, and then the sick come to themselves, and recover their senses: but after the fit there remains an akeing in the head, with a dulness, and hebitude of the senses, and not seldom a turning, or giddiness.

The *Epileptick Paroxysms* are wont to return sometimes at set times of the day, moneth, or year; and most Commonly at the greater returns of the year or Tropicks, or at the opposite aspects, or conjunctions of the Sun, or moon, they are wont more certainly to return, and to afflict more grievously: sometimes their comings or accessions, are uncertain, and wandring according to the occasion, and variety of Evident Causes: there are also Fits or Poroxysms, now more light, which quickly passe away, so that the sick are scarce thrown to the ground, nor are carried into disorder or insensibility; now more grievous, whereby they when taken, lye senselesse the space of an hour or more, and are tormented with horrid Symptoms, as if possessed with the Devil: Sometimes tho more rarely, some foregoing signes of the fit, warn them of their falling into it; as an heaviness of the head, a brightness of the eyes, a tingling of the eares: sometimes a spasm or cramp proceeds, in some exterior part, as in the arm, or thigh, or else in the back, or *Hypochondria*, which ascending from thence, like a Cold air, and creeping towards the head, seems to bring on their falling down. Boys, and young Men are found to be more obnoxious to this disease, than old men, or men of mature age: who ever are once struck down by its fit, unless they be cured by the help of Medicines, they will hardly be altogether free, from the infection of it, all their Life after; the more often the Fits are, the more grievous they become, which as they frequently return become more cruel, and enervate the use of the memory, Imagination, and Reason, and then the strength, and force of the whole animal function, until its Oeconomy being greatly perverted, the vital function at length decays, and by degrees is abolished. The weapons, and wicked preparation of this Disease, being after this manner layd open, we will next make an inquiry, in what part it fixes its seat; or what is its next subject.

The accession of the Epilepsie, and the manner of invasion, seem plainly to declare, that its primary seat, or part chiefly affected, is contained somewhere within the Head; but that a Paroxysm sometimes begins in the remote parts, and from thence ascends towards the head, which indeed seems only to be so, and happens by accident, when in the mean time, the morficick Cause subsists about the *Encephalon* it self, (as shall be anon declared): but that from the first assault of the Disease, presently a strange Insensibility, and disorder, with contractions almost of all the Members and *Viscera* succeeds, it is a manifest signe, that the whole joynting of the *Encephalon*, and the original of all the nerves, are possessed with the morbicick Cause: But truly, although it seem most difficult, to unfold where this cause, or morbicick matter subsists chiefly; for, neither is it probable, that the same is diffused thorow all the parts of the Brain; yet it neither appears in what singular place this being fixed should draw all the other parts so suddenly into a Consent of its evill.

Among the various opinions of Authors, about this matter, there are two that seem more probable than the rest, and challenge an assent with an equall likeliness to Truth. One of which asserts the very middle of the brain, and the other

The Subject or the seat of the Disease is inquired into.

Some affirm it is the Meninges or thin skins of the Brain, other the pith, or middle part of the Brain.

the meninges, or the thin skins encompassing or cloathing it, to be the primary seat of the Epilepsie: The Reason of the former is founded in this, that where the fountain of the animal Spirits, and the original of the sensitive soul it self consists, there ought to be placed the cause of this Disease, certainly when the chief faculties are first hurt, all the rest easily participate of the same evil: But in truth, though I may grant in the Apoplexy, and the *deliquium* or fainting of the spirits, that it is so, yet it follows not in a Convulsion (of which kinde of distemper the *Epilepsie* is) that all the *fibres* and nerves should be pulled together, because the middle part of the brain is first pulled: for that this, as it is a moist and fluid substance, and wanting of sense and motion, seems not capable of contraction, or the Spasmodick Distemper: wherefore others thinking the brain, and every part of it, free from the blame of this Disease, cast it altogether on the meninges: affirming, that the membranes, cloathing the brain, and chiefly their processes, spread upon the clefts of the brain, and *Ceribel*, as they are hauled by the morbidick matter, do conceive or beget Spasms, or horrid Convulsions, and then that from the Meninges themselves, so Contracted and brought together, the included Brain is greatly compressed, and bound together, so that its pores and passages being bound up, the great amazing disorder and insensibility is induced, and also the trunks of the nerves, to which either meninge or skin is fastened, being brought into a consent with them, enter also into Convulsive motions: And indeed after this manner, the formal Reason of the Epilepsie, may perhaps seem to be unfolded; but truly when I consider further of the matter, I think we may differ from this opinion, because it does not appear by what Course, or for what cause, the falling down being at hand, these meninges should beget such horrid Spasms. Nay, it neither appears, how from them, however Convulsive they be, the Epileptick Paroxysm should be induced.

It is affirmed, that the meninges are not first of all affected.

As to the former, it seems an impossible thing, for the meninges to be so contracted, as to their whole Concavities, that being bound more strictly together, like a purse, they should on every side pull together their contents, and draw them into a narrower space: for that the *Dura Mater* sticks most firmly to very many places of the skull, yea, and the *Pia mater* is tyed to it, near the processes of the hollow turnings, by a mutual knitting of the membranes, and every where besides with a Continuity of Vessells: Hence it easily appears, either that membrane, as to the greatest part of it, is immovable, so that they cannot fall into so universal Spasms: but in respect of lesser Spasms, as when a certain portion of this or that meninge, or both together, is pulled, indeed we grant such may happen: for I have often heard those troubled with great headach, to complain extremely of a great constriction of the parts, lying under the side of the skull, sometimes on the right, sometimes on the left, and yet from thence no assault of falling down, has followed: Further as those membranes being notably hurt, do cause great vellications or haulings, yet upon it there is not wont to be an Epileptick fit to follow: for I have known, from an Imposthume in the *Dura mater*, when being broken, and that the stinking matter had knawn the more tender meninges, and shell of the Brain, that the sick have fallen first into an amazednesse, and at length into a deadly Apoplexie, who notwithstanding, in the whole course of the Disease, was free from any Epileptical Symtom. Also I remember, I have seen one, who had the *Dura mater* very much torn, by the instrument of an unskilfull Surgeon, and another, that by a wound, had that with part of his skull taken away, so that a portion of the Brain swelled forth, and yet to neither of them any Epileptical passion hapned: wherefore neither is it likely, that the blood, or humors, or (if any shall so argue) the vapours, compacted within those meninges, can bring in any greater evill, than either a stroke, or wound, inflicted on them, or filthy matter there poured out: Besides, those who are more lightly troubled with the *Epilepsie*, so that they scarce fall down, and have their minds free through the whole assault of the disease, would perceive the membrans to be so contracted, and the globe of the brain to be more straitly thrust together, if there had bin any such kinde of affection; but they on the contrary, seem to have the Brain as it were inflamed, and to be sensible, that the spirits leap forth, and are as it were exploded, with a certain fierceness.

The spirits inhabiting the middle of the brain are the primary Subject of the disease.

And indeed, I think it is very likely so, that the Epileptick Paroxysm is stirred up, from a certain suddain rarefaction, and explosion of the animal spirits, inhabiting

biting the Brain, which are in truth the first, and immediate subject of this Disease; to wit, whereby the Brain it self is inflated, and rendered so insensible, and the Nerves hanging thereto, also put into convulsions: For hence it comes to pass, that the accession of this Disease begins so on a sudden, and determines perfectly without any great provision or remains, of the morbidick matter; because the Infection is not brought so much to the solid parts, as to the Spirits themselves.

We have already shown by what means, the heterogeneous and explosive *Copula*, consisting as it seems of *nitro-Sulphurous* particles, cleaving to the spirituous particles of the animal Spirits, and lastly, being smitten and exploded by them, by reason of plenitude or irritation, produces Convulsive Symptoms: But although this kinde of Spasmodick *Copula*, is first distilled from the blood into the brain, yet, for the most part, it does not take hold of the spirits there, or at least, it stays not long with them, in that place: but rather, being thrust from thence, towards the nervous *Appendix*, causes particular and respective Spasms, near the places affected: But sometimes, if the Spasmodic matter be more plentiful and strong, and the constitution of the brain weak, the heterogeneous *Copula*, being fixed to the Spirits, not only in the nervous stock, but also to those planted within the *Encephalon* it self, causes the Epilectick disposition; and the explosive particles of the Spirits, and this *Copula* knocking one against another, stir up the falling fit. For indeed, since the assault of the *Epilepsie* urging, the Insensibility, and great disorder is for the most part the first Symptom, and all the pathognomick, it may be concluded, that the animal Spirits, lying within the middle of the brain it self, are affected before others; and that therefore, that part, is the principal seat of the Disease: Then, forasmuch as the falling of the sick, or casting to the ground, and spasms of the members and *Viscera*, most often follow that Insensibility great disorder, or leaping forth, of the spirits, it follows that the animal Spirits also inhabiting the nervous System, are imbrued with the same explosive *Copula*, and are drawn into consent with those inhabiting the brain it self, and are excited by them, to explosions purely inordinate; although sometimes (by the whole series of Spirits, planted both in the brain and nervous stock, being like a long train of gunpowder, prædisposed to explosions) an exterior Spasm, beginning a great way off, perhaps in some member or Inward, may afterwards be carried to the Brain, as shall be more fully shown hereafter. In the mean time, it is concluded, that the region of the Brain it self, is always the primary seat of this Disease; and that we ought to suppose, the conjunct cause of the Distemper, not to be water heaped up within the ventricles of the brain, nor a thick or clammy humour, impacted in the passages of its pores: for such Causes are begotten by degrees, and therefore would shew some certain signes before-hand, of the first coming upon one: further, the assault of the fit being over, such a matter could not be wholly discussed in so short a time, but that from its reliques, some impediments of the animal function would remain, which indeed rarely happens in the *Epilepsie*, unless inveterate: but, for the exciting of the falling down, no lesse can be imagined, then that the animal Spirits, which flowing within the marrowie substance of the brain, perform the acts of the interior sense, of the Imagination, and appetite, having gotten an heterogeneous *Copula*, should be inordinately exploded, and so they being disturbed beyond their orders and stations, the Superior faculties of the animal regimen, must suffer an eclipse; then, from this greater explosion of spirits, as it were from a fiery enkindling, other Spirits, inhabiting the marrowy and nervous appendix, being also prædisposed to explosions, conceive the like disorder; and in like manner, cause the explosive Convulsive motions, of the containing Bodys.

For although we conclude, that the middle of the brain, is always the primary seat of the *Epilepsie*, and that from the beginning, the morbidick matter is layd up wholly in that Region; yet the distemper growing grievous, this being more plentifully spread thorow the head, enlarges its bounds, so that it being strowed here and there, and far and neer stretched out, Spasmodic particles, are cast in- to the rest of the Brain, and also into the nervous appendix, like gunpowder or explosive seed, whereby it comes to passe, that at the first approach of that disorder of Spirits, Convulsions follow, sometimes in these, sometimes in those parts, and not rarely thorow the whole Body.

The disease affects secondarily very many parts, of the Nervous System.

CHAPTER III.

The Differences of the Epilepsie, and the reasons of some of the Symptoms are unfolded. Also its Curatory Method is represented.

Thus far of the essence, and the Causes in generall of the Epilepsie, it shall be now our next task, to explicate the differences of this Disease; also the reasons of some of the accidents, and Symptoms, belonging to it: to which we will lastly add, Observations and Histories of sick people, with the method of Curing.

The Reason of the Epilepsie which is said to be excited by consent.

The most notable difference of the Epilepsie, is wont to be taken from the Subject, to wit, that the brain, or part of it, labouring with this disease, is either primarily, and Idiopathetically, or properly, affected, or secondarily, and not but by consent, with other parts: concerning the former kinde, we have hitherto discoursed, as to the other, to wit, in which the falling down seems to arise, from some place without the head, and then lays hold of it secondarily, and as it were by a blast sent from elsewhere; It is to be observ'd, that this kinde of distemper (as *Galen* hath noted) proceeds either from the external, or internal parts: we meet with many examples of Epilepticks, in whom the fit being just coming upon them, a spasm is felt, with a numbness in the hand or toe, or other particular member, which presently from thence, as it were with a pricking or tingling, creeps towards the head, which when it hath attained, immediately the sick party falls flat on the Earth, and is hurried into Insensibility and disorder of spirits, and other proper demonstrations of the Symptom of the falling sickness: neither is it a less usuall *proæmium* of this disease, that there first arises as it were a conflict, in the stomach, spleen, womb, Intestines, genitalls, or other inwards; or that some kinde of perturbation is raised in some of them; then from that place, the ascent of (as it were) a cold air is perceived, to which distemper, follows the accession of the falling evill, with its most horrid provision of symptoms: hence it was commonly believed, that the cause of the Epilepsie, lay hid in the part, seen to be so primarily affected, and propagated its evil to the brain, of its self innocent.

The Conjunct Cause of the Epilepsie consists only in the brain.

But in very deed, as to this, we must say, that in every Epilepsie, not only the procatartick or remoter Cause, but also the conjunct, remains wholly in the Brain; to wit, that the spirits inhabiting it, being disposed to explosions, and there being exploded, bring on or Cause every falling Evill. As to those præliminary Symptoms in some Epileptical people, they sometimes have the place of an Evident Cause, and sometimes only of a signe: For when the evill disposition of any inward, as the stomach, spleen, or womb, happens with the disposition of the Epilepsie, as often as any perturbation is begun in that distempered Inward, it easily happens, by reason of a transmission of the ferment from thence; or a continuation of the spasm to the head, an Epileptical fit is excited in the Brain præ-disposed to act.

But these kind of symptoms of the falling evil, which being suscitated from without, seem to propagate the distemper to the Brain, do often arise from the consent of the Brain it self, and are only signs of the approach of the Epileptical Fit, or of the spirits beginning to be exploded, in the brain: For when the animal spirits planted in the middle parts of the Brain, and Cerebel, and also those in the oblong pith or marrow, neer the beginnings of the Nerves, are so filled with an heterogeneous Copula, that, for the Casting of it off, they are ready to bring on the assault of the Disease, before they are all exploded heap by heap, some spirits lying more outward, in some private Nerves, because they are destitute of the wonted influx of their superiors, fall into certain inordinations, and so begin spasms, which spasms (as it is often the manner in this kinde of distemper) begin at the extremities or ends of the Nerves, inserted to this or that member, or Inward, from whence by degrees, they creep forward to their beginnings; whether being come forth with the spirits, thorow the whole *Encephalon*, before disposed to explosions, being

being moved by that spasms, and so being snatch'd away with a fiery enkindling, are suddenly exploded or thrust out; so they seem to stir up the Epileptick Fit, beginning at first from themselves, as it were secondarily, and by instinct, brought from some other place. After this manner, sometimes the Histerical passions, when beginning in the bottom of the belly, they are Communicated to the Brain, are thought to arise from those Viscera, and to be stirred up by their fault; when in the mean time, the morbid cause subsists chiefly, about the beginnings of the Nerves, as we have elsewhere signified, and shall again show hereafter, when we come to treat particularly of the Spasmodick distempers.

There yet remain other differences of the Falling sickness, to wit, that it is either hereditary, or acquired; again, either kind is variously distinguish'd, by reason of the Age, or time, in which it first comes upon one, to wit, when the first coming of it happens before, or about the puberty, or being of ripe age, or after it; further as to the Efficacy of the disease, into strong, and weak, for as much as the Paroxysms or fits, are with, or without the disorder of spirits, and falling, as to its inordinate manner, whose assaults are wandering, and uncertain, moreover, it is wont to be distinguished, according to the peculiar symptoms, in these, or those sick people, by reason of some disposition, or manifold Idiosyncrasy, or propriety, of the Temperament.

Other differences of the Epilepsie.

But from what has been said before, of very many of the Symptoms, which are to be met with in this Disease, the causes do easily appear, so that there will be no need here, to consider all of them: but of some of them, which seem more intricate, it will not be from the matter, to discourse in this place.

We will therefore first of all inquire, why those sick of this Disease, do not fall as those that are apoplectick, or have swooning fits, but are rather stricken down with violence, against the Earth, or any other bodys, that are by chance opposite to them, as if they were smitten down by some wicked Spirit, so that very often, some part of the head, or face, is hurt, with the violent fall: And those so distempered, even like the Dæmonaicks in the Gospel, are frequently flung into the fire, or the water: but it may be here declared, that the Epilepticks become obnoxious to these kinde of evils, for that the fit coming upon them, all knowledge or providence is taken from them; and further. the nerves neighbouring to the head, being strongly contracted, the whole bulk of the Body is carried away headlong: but in the Syncope, and Apoplexie, the fall of the distempered Body, seems as the ruines of a building, which happens, by reason that its props are taken away: but indeed in the falling Sickness, it is no otherwise than if a house were overthrown, by the blowing up of Gunpowder, which is removed much from the place where it stood.

Why Epilepticks fall down with violence.

2^{ly}. It is commonly esteemed a great pathognomick, or peculiar Symptom of the Epilepsie, if when the diseased being fallen to the earth, and suffering most horrid Convulsions, there flows from the mouth, a spumous Spittle or foam, which indeed is thought to be pressed from the Brain, being strongly contracted, into the palate: But in truth, though it be granted, that this flux of spume be very often a signe of the falling Sickness, yet it is not so appropriated to this disease, but that the same sometimes happens in the Apoplexie, in deep sleep, in hysterical distempers, and other convulsive diseases: Besides, this kinde of Foam, does not descend from the Brain, for there is no passage open, by which it may pass, but from the Lungs being inflated, and elevated even to the Larinx, or the top of the sharp arterie, from whence spittle foams forth, with a certain fervency and ebullition: For the fit of the falling evill growing urgent, when most of the nerves in the whole Body are drawn together, those also that serve for the motions of the Lungs, and Diaphragma, suffer most cruel convulsions, and lifting up all the præcordia upwards, continue them almost immovable, in a long Systole, so that the breathing, and pulse, cannot be at all perceived: In the mean time, because the blood straitned within the bosom of the heart, distends it, and also almost chokes it; the Lungs however hindred, that they cannot be moved after their wonted and natural manner, perform what they can, with a thick and hasty agitation, whereby the blood may be drawn forth from the Heart; by which endeavour of theirs, the shaking aire, by the frequent or thick respiration, raises the viscous or clammy humidity into froth, like the shaking of the white of an egg; by and by it lifts it upwards towards the Cavity of the mouth;

From whence the Foam at the mouth of these troubled with the falling sickness comes.

*Why some in
the Falling
knock their
Breasts,*

*The prognosti-
cation of the
Disease.*

and so at last drives it out of doors: wherefore, a foam or spumous spittle does often succeed in other distempers, where the pneumonic or breathing nerves are either contracted; or are hindred from performing their Function.

3ly. Moreover, from the same reason it comes to passe, that some Epilepticks being fallen to the ground, beat most grievously their Breasts with their Hands, and are hardly to be held from it: for when the Præcordia, being troubled with the spasm, and hindred that they cannot move themselves, after their wonted manner, and the blood stagnating in them, not without a great oppression of the heart, threatens a suffocation of Life; then it is that the sick strikes their Breast, to wit, that the præcordia so shaken, and as it were moved up and down, might renew their motions, and so the blood might be relieved from its stagnation, and the heart from its heavy oppression: and this is done after the same manner, as when some that are sleeping being tickled, or bit by a flea, unknown to themselves, presently rub, or scratch the affected place.

As to the Prognostication of the disease, we have already declared, that it is of very difficult Cure, which difficultly consists in this, that the middle of the Brain (in which is the chief spring and fountain of the animal Spirits) is very much debilitated, not only by the morbid cause, but also by its effects, to wit, the several fits; and its pores loosened, so that they ly open for the entrance of every heterogeneous matter: and so the morbid disposition it self being confirmed, by the repeated Paroxysms, and taking deeper root, it is hardly taken away. But it is to be observ'd, that the Epilepsie sometimes terminates of it self, and is sometimes overcome by the help of medicines: which happens about the age of puberty, and then only, so that, who are not cured, that time being elapsed, that is before the twenty fifth year of age, they scarce ever after recover their health, for about the time of ripe age, there is a twofold alteration of the humane Body, and therefore, there often happens a Solution or loosning of the falling sicknesse, or of any other disease deeply rooted: For first, at that time, the genital humour begins to be heaped together in the spermatick Vessels, from whence it follows, that the Spiritious particles, and what are wont to grow to them, nitro-sulphureous and morbidick particles, are layd up, not only in the brain, but also in the testicles: wherefore, if this heterogenious Copula of the Spirits, be more plentifully caryed to that new storehouse, from thence, the brain becoming free, often leaves the epileptical or otherways morbid disposition. 2. About the time of ripe age, as the Blood pours forth something before destined for the brain, through the Spermatic Arteries, to the genitals, so also it receives as a recompense, a certain ferment from those parts, through the veins: to wit, certain particles imbued with a seminal tincture, are caryed back into the bloody mass, which makes it vigorous, and inspire into it a new and lively virtue, wherefore at that time, the gifts both of the Body and minde, chiefly shew themselves; Hairs break out, the voyce becomes greater, the courses of women flow, and other accidents happen, whereby it is plain, that both the blood and nervous Juice, are impregnated with a certain fresh ferment: wherefore, the morbidic ferments or seeds, unlesse they be overcome by this new natural firment, they afterwards continue untameable even to Death.

*The Epilepsie
is changed in-
to other Di-
scases.*

But that the Epilepsie is sometimes cured by the help of medicines, Experience doth testifie: we shall anon discourse of the method of healing, and shew the reasons of the most famous medicines; in the mean time, as to what further belongs to the prognostication of this Disease, if it end not about the time of ripe age, neither can be driven away by the use of medicines, there happens yet a diverse event in several sick Patients, for it either ends immediatly in Death, or is changed into some other Disease, to wit, the Palsie, stupiditie, or melancholly, for the most part incurable.

As to the former, whenas the fits are often repeated, and every time grow more cruell, the animal function is quickly debilitated; and from thence, by the taint, by degrees brought on the Spirits, and the Nerves serving the Præcordia, the vital function is by little and little enervated, till at length, the whole body languishing, and the pulse being loosned, and at length ceasing, at last the vital flame is extinguished.

But that this Disease often ends in the Palsie, melancholly, or madnesse, the reason is, because the tone, and confirmation of the brain is depraved, by the of-

ten explosions of the animal Spirits, and at length its natural state is so perverted, that, by the morbid particles of another Kinde also admitted, the spirits are fixed, nor are any more exactly prone to explosions, but rather sometimes, by a contrary vice introduced, their Elastick virtue is too much wanting, so that they become dull and sluggish beyond measure; even, as oftentimes the intemperature of the blood, being more cold than it should be, admits the more intense burning of a feavour: and indeed, these depressions of the spirits happens partly by their own proper fault; for that their more agill particles being too much exploded, the more dull or heavy are only left, and from them they are supplied, but partly, as we have said, they happen from the fault of the brain; for that its pores and passages, are so dilated and opened, from the often paroxysms of this falling evill, that afterwards, there is an open passage made, for any heterogeneous, and divers kinds of morbid particles, to enter with the Nervous juce.

Thus much for the Diagnosis and Prognosis, the description and judgment of the Epilepsie, or falling sicknesse; in the unfolding of which, it was necessary to bring reasons not altogether abstruse, and different from the common Pathologie, neither are we constrained to recede, in the Therapeutick or Curatory part of this Disease, from the common and usuall method of curing, in other Distempers: But in truth, the prescriptions of such who follow the ordinarily received Opinions, by which, for the most part, they endeavour to carry away, and wholly to eradicate the morbid matter, by Catharticks only, do little or nothing avail in the falling sickness, yea they are wont frequently to be hurtfull to it. I have known some famous Practitioners, omitting wholly the series of the Curatory intentions, betake themselves to certain Empirical Remedies, without any foresight of the whole: this kind of practise, tho sometimes it succeeds happily, would much more certainly perform the proposed cure, if the Body being rightly prepared, they should in like manner take away all Impediments, by other medicines.

Wherefore, the Indications concerning the Cure of the Falling Sicknesse, shall be (as they are Commonly set down) either Curatory, which have respect to the Fit, and drive it away either coming on, or when upon them, to set it going the sooner: or prophylactic or preventory, which have respect to the Cause of the Disease, which if they can take away, its accessions will be inhibited afterwards.

A general evacuation has scarce any place in the former Intention, for in the fit neither a Vomit, or Purge, and very rarely the opening a veine, are wont to be administred; if the amazed Insensibility and disorder continues very long, sometimes a Clyster is wont to be used, but what that chiefly aims at is, to fix the too fierce and Volatil animal Spirits, and also to suppress their begun Explosions: For which ends, two kinde of Remedies chiefly are made use of, to wit, First, such as repress the animal spirits, being too apt to grow firc and to leap forth, and repell them with some perfume that is ingratefull to them, and Compell them into order: which thing indeed medicines imbued with a volatile, or armoniack salt, or also with a vitriolic sulphur do effect, of which kinde are salt and oyle of Amber, Spirits of Blood, Harts-horn, Sut, tincture of Castor, and such like: for these being inwardly taken, or put to the nose, often times bring help, and the evill Spirits of this Disease, are thought to be driven away, even as in *Tobit*, the Devill was by the fume of the gall of a fish. Secondly, the animal spirits are call'd away, or hindred from their begun explosions, when they are allured, or held busied in some work, they are accustomed to: wherefore, the fit urging, frictions being used and for some time continued, thorow the whole body, do often help: But some that set upright the diseased, and altogether hold or restrain their Arms and legs, from their Convulsive motion, or hold them violently in this or that posture; that also blow things into their noses to make them sneese, and power down strong Cordials at the mouth, and apply either Cupping glasses, and Scarrifications, and handle more sharply with other manner of administrations those sick people, and disturb the manner of the fit, I say this kinde of practise is most often too roughly instituted or ordained: because after this manner, there is a double trouble put upon nature, to wit, one from the disease, and the other not lighter from the standers by, and helpers, when it were wuch better, for the Fit

to be suffer'd to pass over after its own manner, and the sick to endure but one trouble only.

Truly the chiefest care of a Physitian, and efficacy of medicines is used about the prevention of this Disease, that the cause being taken away, or its root cut off, all the fruits might wither; medicines requisit to this Indication, respect many Intentions, which may yet be reduced, to those two chief heads: to wit, in the first place, that the enkindling or matter of the disease, being supplied immediately from the vicious Blood, or nervous Juice, and mediately from the viscera, and first passages, be cut off; then in the second place, that the evill disposition of the Brain, and the spirits its Inhabitants, which is peculiar to the Epilepsie, be taken away.

As to the first Indication, here Vomits, purges, and other things, both evacuating, and altering, yea phlebotomy, and Cauteries, have place; for as much as by these means and ways, the impurities both of the viscera, and humours are subdued or brought away; and their dyscrasie or evill disposition amended: for although these kinde of medicines, and medecall administrations, rarely or never cure the Epilepsie, by themselves, yet those take away impediments, set nature upright; and incite her to encounter her enemy; also, they prepare the way, that so specific Remedies might more certainly, and efficaciously shew their virtues; wherefore usually, whilst they take care to cure this disease, with secrets and hidden mysteries, they make use of those kinde of medicines between whiles, in the spring, and autumn, and other fit times.

2^{ly}. As to specific Remedies, which indeed only, though not allways, are able to reach the Epilepsie and to subdue it; of which sort are the male Pæonie, Mistletoe, Rew, Castor, the Claws of an Elk, preparations of a dead mans Skull, Amber, Corall, with many others. Forasmuch as these are taken without any sensible evacuation, or also perturbation, following in the viscera or humours, it is a wonder, by what formal reason, or virtue of acting, they are wont at any time to help in this disease.

*In what the
Virtue of the
Specificks con-
sists in the
Epilepsie.*

Concerning this matter, intricate and obscure enough, if there may be place for Conjecture, when as we have already asserted, the procatartick Cause of the Epilepsie, to consist in the heterogeneous Copula, joyning or cleaving to the spirits, inhabiting the Brain, and inciting them to præternatural explosions; it follows, that those things which take away, or resist such a cause, must be of that nature, that by strengthening the brain, and binding up its pores, may exclude that Copula, and so fix, and as it were binde the spirits, flowing within the middle or marrow of the Brain, from leaving their Copula, that they shall not be any more apt or prone, to irregular explosions; Perhaps after the same manner, as when gunpowder or aurum fulminans being pounded with sulphure, or sprinkled with spirit of Vitriol loses its thundering virtue. And indeed, these kind of properties, to wit, one or both of them, may be suspected, yea, in a manner detected, in most anti-epileptick Remedies: For truly, Pæony, Mistletoe, Rue, the Lilly of the vally, with many others, abound in a certain manifest astriction, that 'tis likely, their Particles being taken inwardly, and so dilated to the brain, by the Vehicle of the blood, and nervous Juice, do so binde, and shut up its too loose and open pores, that afterwards, they do not ly open, for the Passage of the morbifick matter: Besides, for that these vapourous Concerts, breath forth as it were an armodiack scent or scattering, therefore they are sayd to purifie the animal spirits, to fix them, and to strengthen them, having put off their heterogeneous Copula: This virtue purifying the spirits, proceeding from an armoniac salt, is more apparent in Remedies, which are taken from the famuly of Minerals, and Animals, such are the preparations of the humane Skull, of blood, amber, and coral, as the other more binding, rather exists, in the parts and preparations of Vegetables.

It will not be needfull here, for the curing of the Epilepsie, to propose a compleat method of healing, with exact forms of prescriptions, because there are extant every where among Authors, general precepts, and most choyce Remedies, and the Prudent Physitian will easily accomodate, both the Indications, and that plentiful provision of medicinal stuff, to the particular Cases of the sick. But because we have exhibited a quite new Theorie of this Disease, here also ought to be rendred a Curatory method fited for it: which we shall describe by and by more fully,

fully, after we have shewn you some cases or Histories, of people sick of the Epilepsie.

A fair maid, sprung from parents indifferently healthfull, being her self very well, till about her coming to ripe age, about that time, she began to complain of her head being ill: And first of all, she felt neer the fore part of her head, by fits; a Vertigo or giddinesse, whereby all things seemed to run round; and also whilst this Symptom continued, she was wont to talke idly, and to forget whatever she had but just done; These kinde of fits at first pass'd away within a quarter of an hower, and came again only once or twice in a month, in the interval of which she was well enough: Afterwards, the assalts being made more grievous, by degrees, they also return'd more often, and within half a year, her brain being daily more weakened, this giddinesse or turning round, was plainly chang'd into the Epilepsie, that the sick being struck down to the ground, at every fit, was affected with Insensibility, and horrid convulsions, and also with foam at the mouth. The Domesticks observ'd, that she allways fell on the same side, so that sitting neer the fire, if she sate in the right Corner she would be flung in the midst of the fire, but if in the left Corner, she fell against the wall of the Chimney: once when being left alone in the house, she fell upon the burning Coals, and so miserably burnt her face, and forepart of her head, that the skull being made bare of the skin and flesh, a deep and large eschar was burnt into it: and afterwards the outer shell of it fell off a hands bredth. In the mean time the sick maid, so long as the ulcers contracted by the burning, ran with filthy matter, she was free from the fits, but afterwards, they being healed up, the falling evill returned: This Disease began first to shew it self about the time of puberty; for this maid, presently after the begining of it, had her Courses, and afterwards they constantly observed their set times, though her distemper grew daily worse: Various kinds of medicines being administred to this sick Creature, availed nothing, because it was the custome and practise, of her, and her friends, quickly to change both the Physitian, and method of Physick, if an happy event did not presently follow, and to betake themselves very much to every Empirick, and outlandish Mountebanks.

That in this Case, the Vertigenous Distemper, with a short delirium, was the forerunner of the Epilepsie, it plainly argues, the original of this Disease being planted in the middle of the brain, to depend upon a certain inordination of the Spirits; to wit, those dwelling there, at the begining, begun to admit an heterogeneous Copula; which being more plentifully heaped up, being moved either of its own accord, or occasionally, while it was shaken off, induced, by reason of the spirits being disturbed, and not yet very explosive those former distempers; Afterwards, from the same cause, by degrees growing worse, the perturbations of the Spirits did raise up their manifest explosions, and chang'd the vertigo, and *Delirium*, into the Epilepsie.

But that this maid began to be sick, about the time of ripe age, it hence evidently follows, as the natural ferment, so sometimes the præternatural, explicates it self, first at that time; wherefore, as it happens, that the menstruous purgations doe then first break forth; so the seeds of the falling sickness, whether innate or acquired then budded forth a little, and by degrees were ripened into fruit: when the præternatural Ferment first appears, oftentimes the natural following, blots it out, hence the Epilepsie of young ones, often ends about the time of puberty or ripe age, but if that Ferment, or taint of the disease, comes after the menstruous flux, or together with it, and ceases not presently, it remains for the most part afterwards, during Life, of it self untameable, and not to be overcome by any Remedies.

From this observation, that a Caustery accidentally, and by chance being made on this sick party, freed her from the fits of the Disease, it may be inferr'd that fontanells or Issues, may be profitably administred, in the Cure of the Epilepsie: for wheresoever an emissary is opened, for the constant carying away of the ferrous water, both from the blood, and nervous juce, there very many heterogeneous and morbidick particles, flow out with it, that therefore the brain might remain free.

The Daughter of a Brewer of *Oxford*, had been very obnoxious to a Rheume falling into her eyes, from her Infancy, otherwise strong and sound enough, also accustomed daily to hard labour, about the 14th. year of her age, she began to be

be tormented with Epileptick fits, of which she suffered neer the greater changes of the moon, especially then returning: Being asked to endeavour her Cure, I gave her a Vomit of precipitate Solar, and order'd it to be renewed three days before every new, and full moon; besides that she should take at every turne, for four days after the Vomit, twice in a day, a dram of male-Pæonie root in powder, with a draught of black Cherry water. By these remedies, the fits so long intermitted, that the Disease seem'd to be Cured. Afterwards when they returned again, she was again recovered by the use of those medicines: and then the menstruous flux breaking forth, and observing its true periods, she remained for the future, free from that disease.

The Therapeutic or Curatory Method.

Vomitaries.

IN the Curing of the Epilepsie, I judg it fit to begin with a Cathartick, and if the sick can easily bear vomiting, first let an Emetick be administred, and for several months, let it be repeated, four days before the full of the Moon. For Infants, and youths, may be prescribed wine of Squills, mixed with fresh Oyle of Sweet Almonds, or also of Salt of Vitriol, from half a Scruple, to 1. Scruple: For those of riper years and of a stronger Constitution may be prescribed the following forms of Medicines. Take of *Crocus mettalorum*, or of *Mercurius vitæ* gr. iiii. to vi. of *Mercurius Dulcis* grain xvi. ʒi. let them be brused together in a mortar, mix it with the pap of a roasted Apple or of *Conserve of Burage* ʒi. make a Bolus; or you may take an Infusion of *Crocus Mettalarum* or *Mecurius Vitæ* made in Spanish wine from ʒ ʒ. to ʒi ʒ. or take of *Emetick Tartar* of *Mynsicht* gr. iv. to vi. who are of a tenderer constitution, let them take of the *Salt of Vitriol* ʒi. to ʒ ʒ, and half an hour after let them drink severall pints of posset drink: then with a feather or finger put down the throat, let vomiting be provoked, iterate it often.

Purges.

The day following the vomiting, unless any thing shall prohibit, let blood be taken out of the Arm, or from the hæmorrhod veins with a Leech: then the next day after let a purging medicine be taken, which afterwards may be repeated constantly, four days before every new Moon.

Take *Resine of Jalop* ʒ ʒ. *Mercurius Dulcis* ʒi. of *Castor* gr. iii. of *Conserve* of the *Flowers of Peony* ʒi. make it into a Bolus. Take *pill fetida* the greater ʒii. of *Hysterica* what will suffice, make thereof v. pills. Take of the strings of *black hellebore* macerated in Vinegar, dry'd, and powder'd ʒ ʒ. of *Ginger* ʒ ʒ. of the *Salt of Wormwood* gr. xii. of the *Oyl of Amber* drops ii. make a powder, let it be given in the pap of an Apple. Take of the powder of *Hermodactils* compound ʒi. of *humane Scull* prepar'd gr. vi. make a powder, let it be given in a draught of the decoction of *Hyssop*, or *Sage*.

On those days that they do not purge, especially about the time of the changing of the Moon, let there be administred Specifick Remedies morning and evening, which are said to cure this Disease, with a certain innate and secret virtue: of these there are extant a very great company, and are prescribed in various forms of Compositious.

Specificks.

The most simple Medicines, which Experience hath found to be very Efficacious, are the root of the male *Peony*, and the seeds of the same. Take of the Root of the Male *Peony* dried and powder'd ʒi. to ii. or iii. let it be given twice a day in the following Tincture. Take of the leave of *Mistletoe* of the Oak ʒii. of the root of *Peony* slic'd ʒ ʒ. of *Castor* ʒi. let them be put into a close Vessel with simple water of *Betony* or *Peony*, and white-wine Each ʒi. of the *Salt of Mistletoe*, of the Oake or the Common *Mistletoe* ʒii. let them digest close in hot sand for ii. days, let them take ʒiii. with a dose of the aforesaid powder.

Poor people may take of the aforesaid powder, in a decoction of *Hyssop* or *Castor*, made with fair water and white-wine.

At the same time, let the Root of *Peony* be cut into little bits, and being strung upon a thrid, hung about the neck. Also let the Roots being fryed in a pan, or boyled tender, be eaten dayly with their meat.

Take of the Roots and Seeds of the male *Peony* each ʒii. of *Mistletoe* of the Oake, of the hoof of Elk ʒi. each let them be sliced and brused, and pnt into a thin silk bag, and hang at the pit of the Stomack.

Among

Among the ſpecificks, this powder is greatly commended by many Authors. Take of *Caſtor Opoponax*, *Dragons blood*, *Antimony*, and the ſeed of *Peony*, each alike, make a powder, of which may be taken ʒ ſ. to ʒ i. every morning, with wine, or ſome proper decoction, or with *black Cherry water*.

Powders.

Take of a *mans Skull* prepar'd ʒ i. of *Miſſetow of the Oake*, of *Counterfeit Cinaber*, of an *Elks Claw*, each ʒ ſ. ſo mingle them. The doſe is ʒ ſ. to ʒ i.

If the form of powder be diſtaſtful to any one, or if it ſhould become loathſome by the long uſe of it, *Electuaries*, *Pills*, *Troches*, *Spirits*, and *Elixirs*, each of which agree with ſpecifick medicines, are wont to be preſcribed.

Take of the *Conſerve* of the *male Peony*, of the *Lilly of the Valley*, each ʒ iii. of the ſeed and root of the *male Peony* powder'd each ʒ ii. prepared *Corall* ʒ i. of the powder of *Pearls*, and of *humane Skull* prepared, each ʒ ii. of the ſalt of *Miſſetow*, of the *Oake* ʒ i ſ. with what will ſuffice of the *Syrop* of *Corall*, make an *Electuary*, let them take of it morning and evening, the quantity of a *Nutmeg*.

Electuaries.

Take of the powder of the root of the *male Peony* ʒ i. of the ſeeds of the ſame ʒ ſ. of *Miſſetow of the Oake*. of an *Elks claw*, of *humane Skull*, prepared, each ʒ ii. of the roots of *Angelica*, *Contrayerva*, *Verginian Snake-weed*, each ʒ i. of the whitest *Amber*, of *Calcined Corall* each ʒ i. of the *Common Salt* of *Miſſetow*, ʒ ii. of *Sugar Candy* ʒ viii. diſſolved in what will ſuffice, of the *Antiepilepticall water* of *Langius*. Make a *Confection*, of which take twice in a day, the quantity of a *Nutmeg*.

Theſe powders, by adding to them, the *Salt* of *Amber*, and *Harts-horn*, with what will ſuffice of *Balsome Capivi* may be formed into a *pillulary Maſs*, of which may be taken iii. or iv. pills, in the morning and evening, drinking after them a draught of ſome appropriat *Liquor*.

Pills.

Or of thoſe ſorts may be prepared an *Elixir*, of which may be taken viii. drops to x. twice in a day, in a ſpoonful of a proper *Julap*, drinking a little of it after it.

Take of *Hungarian Vitriol* vi. pints, let them be diſtill'd with a glaſs retort in hot ſand for 24. hours, then let the ſame retort, being defended or done over with *Clay*, be put with a large receiver in a reverberating *Furnace*, that the acid ſpirits may be forced with a moſt ſtrong fire, till they come forth. The whole *Liquor* being diſtilled, let it be drawn off in hot ſand, in a leſſer glaſs retort, and let there be poured into the *Matrace*, of the roots of *Male-Peony*, cut into pieces and dryed ʒ iiiii. of the ſeed of the ſame ʒ i. of *humane Skull* prepared, of *Elks claws*, and *Red Corall* each ʒ ſ. *Miſſetow of the Oak*, ʒ ii. let it digeſt with a gentle heat for ſeveral days, to the extraction of a tincture, the *Liquor* being decantated, let it be drawn off in a glaſſe Retort to a third part remaining: being ſtill'd forth keep it by it ſelf: to thoſe Remains pour of the rectified *Spirit* of wine a little quantity, impregnated with the *Infuſion* of the ſame ingredients, and let it digeſt for ſix days in horſe-dung, the doſe of which is ʒ ſ. to ʒ i. The diſtilled *Liquor* may be given from half a ſpoonful to a whole ſpoonful, for the ſame Intentions.

Elixir.

Or let there be prepared an oyl, out of the *Salt* of *Venus* or *Copper*, according to the deſcription of *Henry Van Heers*, and given as there preſcribed.

Among the ſpecifick Remedies, which (when the former ſhall not be profitable) ought alſo to be tryed, are the *Livers of Frogs*, the *Gall of a Bore*, dryed with *Urine*, The powder of *Bryony Root*. The powder of a *Cuccow*, of *Crows*; the *runnet* and *lights* of a *Hare*, the *Liver of a Wolf*, *ſtones taken out of Swallows*, the *Liver* of a *Kite*, the *Eggs of Crows*, with many more, to be dayly taken with food or Medicine; a famous Catalogue of which is extant of *Henry Van Brays*, a Phyſitian of *Zutphen*: and from which, preſcripts for poor people, may be taken, eaſie to be prepared, and without great coſt.

Empirical Remedies.

Whiſt theſe kinde of Remedies are to be taken inwardly, according to the aforeſaid method, ſome outward adminiſtrations being applyed, bring help, and are deſervedly admitted to part of the cures; therefore, allways Iſſues are made in this diſeaſe, in one fit place or other, and alſo more often *Veſicatories* or *Bliſters*.

Amulets hung about the neck, or born at the pit of the *Stomach*, are thought to be uſeful: The freſh *Roots of Peony* cut into little ſquares, and being ſtrung like bracelets, and hung round about the neck, and as ſoon as they are dry, let new be put in their places, and they being reduced to powder, may be taken inwardly: Take of the roots and ſeeds of *Peony* each ʒ ii. of an *Elks claw*, and *humane Skull* prepared, each ʒ i. of *Miſſetow of the Oak*, ʒ ſ. let them be beaten into groſſ powder

Amulets.

powder, and sowed in a piece of red silk, and like a little bag let it be hanged about the neck.

An *Amulet* of a stalk of the *Elder*, found growing in the *Willow-tree*, is greatly Commended.

Plasters.

It agrees with some, to have their heads shaven and a plaster applied to the fore-part. Take of the root and seeds of *Peony*, of *Castor*, *Mistletoe* of the *Oak*, of humane-skull most finely powder'd, each \mathfrak{z} i. of betonie plaster \mathfrak{z} ii. *Caranna Tacamahacca*, each \mathfrak{z} ii. *Balsum Capive*, what will suffice, make a mass, and let it be spread upon leather, make a plaister for the suters of the Head.

Let the Temples and Nostrills, be often anointed with Oyl of *Amber*, by it self or mixed with oyl *Capive*.

*Sternutories
or sneezing
powders.*

Sneezing Powders, and such as purge the head of *Rhume*, are to be used dayly in the Mornings: Take of white *Hellebore* \mathfrak{z} i. of *Castor*, and *Euphorbium*, each \mathfrak{z} ss. the leaves of sweet *Marjorum*, and *Rue*, each \mathfrak{z} ii. make a powder; make a decoction of *Sage* or *Hyssop*, with *Mustard* dissolved in it, with which gargle the mouth and throat.

A Glisten may be sometimes used, as need shall require.

Sometimes the more solid Medicines are to be moistned with liquids, or they ought to be drunk after them, for which end, distilled waters should be at hand, *Fulups*, *Tinctures*, or *Decoctions*; which are endued with a certain Specific Virtue against this Disease.

Distill'd Water.

Take of *Hungarian Vitriol* four pound, of the powder of fresh humane-skull, four ounces, of the root of *Peony* sliced, six ounces, let them be bruised together in a mortar, put to them either of *Spanish wine*, or small white-wine, or wine made of the juce of black-Cherries, a quart; being fermented in a vessell, let it be distill'd in a glass retort, in hot sand.

Take of the shavings of box-wood, of *Hungarian vitriol*, each two pound, of the *Mistletoe* of the *Oak*, or the *Common-Mistletoe* leaves, three handfulls, of *Rue* two handfulls, being bruised together, put to it of *Spanish wine* 4 pints: Let them be distill'd in a glass Cucurbit with hot sand.

Fulups.

Take of *Common Vitriol* six pound, of the root of the male-peony six ounces, of the *Mistletoe* of the *Oak* one ounce, of *Green-walnuts*, viii. ounces, being cut and bruised; let them be distilled in a glass-pot, a glass alembick being placed upon it, in hot sand. Take of this Liquor one pint, of black cherry water, and of the water of the flowers of the roil, or *Line-tree*, each half a pint, of white-Sugar, \mathfrak{z} iii. mix them, and make a *Fulup*, the dose \mathfrak{z} ii. to iii. twice or thrice in a day.

Oxymel of squills, also an hony-decoction with *Hyssop*, are much praised by the Ancients. Or an *Apozem* of this kinde may be prepared, of which may be taken \mathfrak{z} iii. to vi. or viii. twice in a day.

Apozems.

Take of the roots of male-peony, *Angellica*, *Imperatoria*, *Valerian*, each \mathfrak{z} vi. of the leaves of *Betony*, *Sage*, *Lilly* of the *Valley*, *Penny-Royall*, each one handfull, of the seeds of *Rue*, *Nigella*, each \mathfrak{z} iii. *Peony*, \mathfrak{z} ss. of *Raysons*, \mathfrak{z} iii. of *Liquoris* \mathfrak{z} ss. being cut and bruised, let them be boyled in vi. pints of *Spring-water*, to the Consumption of the third part. Towards the end, add of black Cherry-wine; half a pint, or ten ounces, strain and keep it in close Vessells. The dose is from vi. to viii. ounces, twice in a day, after the afore-prescribed Remedies.

Or the aforesaid Ingredients, excepting the *Liquoris*, and *Raysons*, may be boyled in vi. pints of *Hydromel*, or water and hony, or meath, to the Consumption of the third part: The dose \mathfrak{z} iii. to vi.

Great Remedies.

If that the aforesaid Method, consisting in the use of *Catharticks*, and *Specificks*, being for some time tryed, and altogether in vain, you must come to Remedies of another kinde, and chiefly to those called Great, or Notable: In this rank are placed *Diaphoreticks*, *Salivation*, *Bathes*, and *Spaws*.

Alphonsus Ferrinus affirms, that he had cured many Epileptical people, with a decoction of simple *Guaicum*, being prescribed twice in a day, and taken, to vi. or viii. ounces, and its second decoction drunk (as in the cure of the *Pox*) instead of ordinary drink. If to such a decoction the roots of *Peony* and other specificks should be added, perhaps it would be more efficacious. It seems probable, that a *Salivation* strongly excited from *Mercurie*, and afterwards a *sudoriferous* or *Sweating-Diet* following, might certainly cure this Disease. What *Baths*, or *Spaw-waters* are able to do, I have not observ'd, either by my own or others experience.

Perhaps

Perhaps I have made tryall, that our Artificial *Spaws*, sometimes have been available in Curing the Epilepsie, to wit, both those impregnated with *Iron*, and also with *Antimony*, and taken in a great quantity, for many days.

CHAPTER IV.

Of other kinds of Convulsions, and first of the Convulsive Motions of Children.

After the Epilepsie; as it were the principal Spasm, in the chief place excited, to wit, within the middle part of the brain, the other Kindes of Convulsions come to be treated of in order. The differences of those, are best taken from a two-fold kinde of cause; and the various manners, and accidents of either. We have already shown, that all Spasmodic distempers, do flow, either from the meer irritation of the spirits or from their explosion, by reason of the cleaving of an Elastick *Copula* to them, or jointly from both, together: wherefore, the manifold Ideas of Spasms, may be distinguished, and distributed into certain Classes, as it happens for this, or that cause, or either together, to remain in the various places of the *Encephalon*, or the nervous Appendix. For indeed, the Spasmodic matter, or the explosive Copula of the Spirits, finding a passage chiefly, and most often thorow the Brain, and sometimes in some measure thorow the extremities of the nerves, subsists either about the origine of the nerves, or their middle processes, or their outmost ends, or abounds in their whole passages, as shall be by and by more particularly declared: Further, an irritation stirring up Convulsions by it self, or with a previous remote cause, although it be made every where in the nervous stock, yet it chiefly, and more frequently produces such an effect, about the beginnings, middle processes, and foldings, or ends of the Nerves. But the same Kinde of Cause and effects, are after one manner in Infants and children, and another in youths, and those of riper age. Since therefore we have determined, particularly to consider, all the kinds of Convulsions, we will first discourse of the Convulsive motions of Infants, and Children.

Infants, and children, happen so ordinarily, and frequently to be tormented with Spasmodick Distempers, that this is reconed the chief, and almost the only Kinde of Convulsions; for the Symptoms of this kinde, in other more ripe people, are wont to be called by other known Names, and referred to the Epilepsie, hysteric, hypochondriac, Collic passions, or also to the Scurvie: but in children, they are called, as it were by way of Excellency, Convulsions.

As to this we must observe, that children are found to be greatly obnoxious to Convulsions, chiefly about two seasons, to wit, within the first month after they are born, or about their breeding of Teeth: Although it often happens, that the assaults of this Disease; may come also at other times, and from certain other Causes.

In the first place therefore, it very often happens, that children newly born, or at leaster e they are two months old, are afflicted at every turn with Spasms, excited in divers parts; for that inversions of the eyes, distortions of the cheeks, and Lipps, or tremblings, yea Contractions of the Tendons, and frequent jerkings or leapings forth of the members, and sudden shakings of the whole Body, infest them; and that the same effect likewise sometimes afflicts the præcordia, appears plain enough, because whilst the Spasms busie the Limbs, and outward members, also the face becomes now pale, now of a livid, or dead Colour, from the blood stagnating in the heart, and the Lungs being at that time contracted. As therefore, Spasms are wont to infest three Regions of the Body in children, to wit, the parts of the head and face, the outward members and Limbs, and the Præcordia and viscera, we observe now these regions, now those, now, two or all together to be possessed, by the morbid Cause, to wit, as it is fixed, either about the beginnings, or ends of the nerves; and when the former of these hap-

pens, as the superior part of the oblong pith, the middle, or the lowest part of the spinal marrow, is touch'd, one, or more parts together, are assaulted by the morbid Cause.

As to the other Causes of this Distemper, to wit, the procatartic and evident, those of the former Kinde, do chiefly consist in two things, first that all the parts of the Head in Infants are very weak, and abound with a viscous humidity; to wit, the Brain less firm, and the tone of the nerves very loose, so that they are not able to bear the more light force of every matter, but the Spirits inhabiting them, are easily incited into irregular motions or Spasms, by the proper liquor, wherewith those parts are watered, if it flows never so little immoderately, or at least more plentifully, than for the measure of so little strength. But in the second place, because it appears by observation, that children, not only, nor all, who are of a more tender Constitution, are found to be prone to this Disease, therefore, this ought to be rather accounted for a reason, of the more remote morbid Cause, that the Blood, and nervous Juice, are originally vicious, in some Infants, by reason of evils contracted from the womb: For that the sanguineous mass, wanting eventilation for many months past, becomes impure in children newly born; wherefore, broad and Red puttings forth, like the small pocks, shew themselves through the whole skin, in most children, soon after they are born; to which sort of weakks, or efflorescences, if they are hindred, or repressed, oftentimes dangerous exulcerations, about the parts of the mouth follow. Hence we may deservedly suspect, such impurities of the blood, sometimes to be poured forth into the brain, and nervous stock, considering their debility, and for that reason Spasmodic Distempers to arise; to wit, whilst the blood being vitious from the womb, endeavours to purifie it self, it transfers its feculencies into the head, which were wont to be exterminated by the putting forth the Red-gum, or red spreadings thorow the skin: Wherefore, a water now thin, and Serous, now thick and sticking, and either participating of præternatural Salts and sulphures, is layd up within these or those recesses, and Cavities of the Brain, Cerebel, and oblong pith, the recrements of which, when they begirt the beginnings, or ends of this or that nerve, and sometimes many together, affix on the Spirits inhabiting them, heterogeneous particles, and apt for Spasmodic or Convulsive explosions. For as soon as the nerves have deeply imbibed such particles, the spirits being burthened with their Copula, endeavour either of their own accord, or being incited by evident Causes, to thrust, and shake it off; and so they enter into Spasmodic, or Convulsive explosions.

The evident Causes, which bring on Convulsive motions in children prædisposed, are of two Kindes, *viz.* In the first place, whatsoever stir up unwonted effervescencies of the blood, whether they be excesses of heat or cold, a too plentiful nourishment, or hotter then should be, the changes of the air, and weather, and chiefly the periodical times of the Moon; for by reason of these, and other the like occasions, the Blood growing more hot than by right it should be, affixes sooner to the Spirits an heterogeneous Copula, even to a fullness, and causes it presently to be struck off, and exploded, by them thoroughly disturbed. 2^{ly}. An Irritation, in almost every part of the nervous System, does not seldome bring into Act, a Spasmodic or Convulsive Disposition: wherefore, not only an excess of tangible qualities, outwardly inflicted, but the milk Coagulated in the stomach, choler, or other sharp humours, or also wormes knawing the Intestines, are wont to excite Spasms or Convulsions: Besides, these kinde of evident Causes, as they are stronger, sometimes induce Spasmodick Distempers of themselves, and without a prævious Disposition: even so worms, and perchance sharp humours, cause Convulsive motions to some children, at least to the more tender.

That it might more certainly, and to the sense appear, what kinde of morbid matter might be in Convulsive motions, I have opened the dead bodies of many, which this disease had oppressed: I have allways in vain sought the cause, within the Viscera, and first passages of Concoction; In the heads of many, a ferous water being heaped up, within the Cavity, under the Cerebel, and distending the Membrane which cloaths the oblong pith or marrow, did overflow the beginnings of the nerves: in some, no footsteps of this Disease appeared: so that, what sticking to the Spirits did irritate them into explosions, was of so imperceivable a bulk, and its originall so altogether hid, that it could not be found out,

by

dy the most perspicacious scrutiny of the sight. Sometime past, in this City, many chilbren of a certain woman dyed of this Disease, at length, the fourth, as the others, dyed within the month; we dissected the Head, and here no serous Colluvies or water did overflow the ventricles, but only the substance of the Brain, and its appendix, was moister then ordinary, and looser; what was most worthy of observation was, that in the Cavity, which lyes under the Cerebel, upon the trunk of the oblong pith, we found a remarkable heap of clotter'd, and as it were con-creted blood: but in truth it is uncertain, whether this matter, deposited there from the begining, had primarily caused the convulsions; or rather, whether this blood being extravasated, and expressed, by the contraction of the parts, planted round about, was not the effect, and product of the Convulsions, and not the cause of them; for also in Apoplectical people this kinde of Phænomenon ordinarily happens, which yet we shall afterwards shew, to be rather the effect, than the cause of the disease.

Indeed, the heterogeneous Particles, which flow to the blood, from the womb, are wont to be sent away through efflorescencies or Cutaneous Pustles in the whole Body, in many children, in others being poured on the head, are the material cause of the Convulsive Distemper, may be inferr'd, besides the reasons before recited, from the remedies chiefly helping: For that in little children obnoxious to this hæreditarie Disease, the Convulsive fits are best prevented, if that an Issue be made Presently after they are born, in the nape of the neck, and blood drawn with a Leech from the jugular Veins; for the corruptions of the nervous juce, are brought away by that, and the impure buddings of the blood, are diverted from the head by this: by these ways of Administrations, when before two or three children, of the same Parent, have dyed of Convulsions, soon after they were born, all the rest have been freed from the same evill.

2ly. Thus much concerning the Convulsive motions of Children, which are wont to infest them, by reason of an Infection contracted from the womb. If that at this bout they should escape the Disease it self, or at least its deadly strokes, nevertheless, about the time of breeding teeth, they would be found at last to be obnoxious, to the same danger: for when the Teeth, especially the greater, are about to cut, oftentimes a feavour is excited, to which not seldom Convulsions are Joyned: and though at this Time, children are grown stronger, and may better bear the fits of the disease, then when new born, yet the convulsive Distemper, now stirred up by no other grievous occasion, becomes very dangerous, and sometimes deadly.

But forasmuch as children, who fall into feavours, about the time of breeding of Teeth, are not all tormented with Convulsions, it therefore follows, that some disposition to this disease, either innate, or acquired, doth precede; and that the pain caused from the breeding the Teeth, is to be esteemed only the means of a more strong evident Cause, to wit, Children, who being indued either with a Cacochymia, or juce causing ill digestion, or with a more weak constitution of the brain, and nervous stock, have their animal Spirits too much adulterated, or dissippable, are sometimes disposed for the coming of Convulsive distempers: wherefore, when so acute pain, together with a feavor, afflicts, that latent disposition is brought into Act.

If it be here ask'd, for what reason a feavour, and then Convulsive motions following thereupon, come to those Prædisposed, in teething, it may be answer'd, that either effect may be attributed to the pain, as the immediate Cause: We experimentally know by our selves, what the torment is, that follows an irritation about the roots of the Teeth; in truth so great, and so cruell; that a more cruell can scarce be; for that one or two notable shoots, of the 5th pare of nerves, reaches to the roots of each Tooth, which when it is hauled by the sharp particles of the Blood, or other humours, there layd up, causes a most sharp sense of trouble, or pain, by its Corrugation: But this kinde of Vellication or hauling of this Nerve, happens thus to children breeding teeth, because that the membranes and fibres, are every way distended, by the Teeth, now increasing into a greater bulk, and as yet included within the scarce hollow gums: hence the blood being hindred in its Circulation, causes a tumour, and so presses the nerves, and also pours on them the more sharp particles of the Serum, by which, being notably pulled or hauled, they are tormented with Corrugations, and painfull Spasms.

Therefore, when so cruel pains happen to children, from their breeding Teeth, it is no wonder if a feavour, and also Convulsive motions sometimes follow: the former of these happens, both for as much as the blood being hindred about the pained part, is not circulated with its wonted and equall course, wherefore it becomes inordinatly moved, in the whole Body; and besides, because Spasms being stirred up somewhere in the nervous stock, the corrugated and contracted nerves, presse together, and pull the Arteries, and by that reason, stir up irregular and feavourish fluctuations in the Blood. But sometimes Convulsions happen in breeding Teeth, both because the blood growing hot, sends forth heterogeneous particles, to the animal government, and so stirs up the spirits into explosions; and besides also, when this acute pain, and as it were a Lancing, follows upon the teeth being about to cut, it communicates a very troublesome and irritative sense, from the affected parts, to the first sensorie, presently from thence, the motion of the rage is retorted, by the same or other neighbour nerves, which by reason of a prævious disposition, doth not rarely become convulsive.

Besides these two occasions of Convulsions (which are wont to be chiefly, and more often in children) to wit, the times of Infancy, and breeding Teeth, this Distemper also is excited at other Times very often, and for other Causes: For in whom the Seeds of the Spasmodick Disposition is sown, they sometimes unfold themselves presently after the birth, and are ripened into morbid fruit; or else lying hid for a while, they now come before the breeding of Teeth, and follow a long time after it; and by reason of other evident causes, to wit, either external, or Internal; of which sort are a sickly, or breeding nurse, milk Coagulated in the stomach, or degenerating into an acid or bitter putrefaction, a feavourish distemperature of the head, Ulcers or weakks of other parts suddenly vanishing, the Changes of the aire, the Conjunctions, oppositions, and aspects of the Sun, and moon, and such like; they at length break forth into Act, from an uncertain event. Concerning these, there is no need, that we should particularly discourse.

When all the Children, of a man dwelling in the neighbourhood, dyed of Convulsions, within the space of three months, at length, to prevent that fatal event, they sought for remedies, for a child newly born: I being sent for, a few days after the being brought to bed, first advised the making an Issue in the nape of the neck, then, that the next day after, a leech being applyed to the jugular veine of each side, two ounces of blood should be taken away: besides, that about every conjunction, or opposite aspect of the Sun, and moon, about five grains of the following powder should be given, in a spoonfull of Julap, for three days, morning and evening. Take of humane Skull prepared, of the root of the male Pæonie, each \mathfrak{z} i. of the powder of Pearls \mathfrak{z} β . of white sugar \mathfrak{z} i. mingle them, and make a very fine powder: Take of the waters of Black Cherries \mathfrak{z} iii. of the antiepileptic of Langius \mathfrak{z} i. of the Syrrup of the flowers of the male Pæonie \mathfrak{z} vi. mingle them; also I order'd that the nurse at the same times, should take a draught of whey, or posset drink, in which were boyled, the seeds and roots of the male Pæonie, and the leaves of the Lilly of the Vally, the Infant for about four months was well, but then began to be troubled with Convulsions: at which time, the same Remedies being administred both to the child, and to the nurse, in a larger dose, vesicatories also were applyed behind the eares, and blood was taken by the sucking of a Leech, from the jugular veins: within two or three days the child grew well: afterwards, whenever within four or five months the Convulsions return'd, it was cured again, by the use of the same Remedies. After half a year, the Convulsive motions wholly ceased, but a painfull Tumour arose, about the lower part of the *Spina dorsæ* or back-bone, from which proceeded a certain distortion of the *Vertebra*, or joynts of the back bone, and a weakness of the legs, and at length a Palsie. It seems in this case, that the Spasmodic or Convulsive matter, being wont to come upon the brain first, and beginnings of the nerves, entring at last the Spinal marrow, and being thrust out at its further end, it wholly stopt up the heads of the appending nerves, and shut out the passage of the Spirits: to wit, because other narcotick, and more thick, had joyned themselves, to the explosive particles.

The Curatory Method against the Convulsive Distempers in Children.

IT is to be endeavour'd either to prevent the Convulsive passions, threatening Children and Infants, or to cure them being already begun.

For if the former children of the same parent, were obnoxious or lyable to Convulsions, that evil ought to be prevented timely, by the use of Remedies to those born after: It is usuall for this end, to put into the mouth of the child newly born, some antispasmodick Remedy, as soon as it begins to breath: from hence some are wont to give them some drops of the purest hony, others a Spoonfull of Canary sweetned with Sugar, and some again oyl of Sweet Almonds fresh drawn, to some may be given half a Spoonfull of epileptic water; or one drop of oyle of Amber.

Besides these first things given to Infants, which certainly seem to be of some moment, certain other Remedies and means of Administrations, ought to be used: to wit, let one spoonfull of Liquor, proper to this distemper, be drunk twice a day: as for example; Take of the water of black Cherry and of Rue each \mathfrak{z} i β . of the Antiepileptic of Langius \mathfrak{z} i. of the Syrrup of Corall \mathfrak{z} vi. of prepared Pearl *gr.* xv. mix them in a Viol. On the third or fourth day after the birth, let an Issue be made in the nape of the neck, then if it be of a fresh Countenance, let a little blood to about \mathfrak{z} i β . or ii. ounces be taken, by the sucking of Leeches, from the jugular veins, having a care lest the blood should flow out too plentifully in its sleep; let the temples, and the hinder part of the neck, be gently rub'd with such a like oyntment. Take of oyle of nutmegs by expression \mathfrak{z} ii. of Capive \mathfrak{z} iii. of Amber \mathfrak{z} i. Let an Amulet be hung about the neck, of the roots and seeds of the greater Pæonie, a little of the hoof of an Elke being added to it.

Moreover antispasmodick Remedies, should be dayly given to the Nurse: Let her take morning and evening, a draught of whey or posset-drink, in which the roots and seeds of the male Pæonie, and sweet fenill seeds are boyled. Take of the Conserve of the flowers of Betony, of the male Pæonie, and of Rosemary each \mathfrak{z} ii. of the powder of the Root, and flowers of the male Pæonie, each \mathfrak{z} ii. of red Corall prepared, and of the whitest amber each \mathfrak{z} i. of the roots of Angelica, and Zedoarie prepared, each \mathfrak{z} β . with what will suffice of the Syrrup of Pæonie, make an Electuarie: let her take morning and evening, the quantity of a Nutmeg.

Take of the powder of the root of Male-Paony \mathfrak{z} ii. the seeds of the same \mathfrak{z} i. make a powder; of the whitest Sugar \mathfrak{z} iii. dissolved in the water of the flowers of the Line-tree, and boyled to tablets, of the oyl of Amber \mathfrak{z} i. make tablets according to Art, each weighing \mathfrak{z} β . let her eat one every sixth hour. Also let her keep to an exact dyet.

If any Infant be actually afflicted with Convulsions, because that an Issue operates little, and slowly, it will be expedient to apply blistering plaisters, to the nape of the neck, and behind the ears, and unless a more cold temperament should gain-say it, let blood be drawn with Leeches, from the veins: Let Liniments be used about the Temples, Nostrills, and hinder part of the neck, and plaisters also laid to the bottoms of the feet; Clysters that may keep down the belly, should be dayly administred: besides let specifick Remedies be inwardly taken, often in a day, to wit, every sixth or eighth hour.

Take of the oyl Capive, of Castor each \mathfrak{z} ii. of Amber \mathfrak{z} β . make a Liniment.

Take of the plaister of Oxycrocia two parts, of dissolv'd Galbanum one part, of oyl of Amber \mathfrak{z} i. make a plaister for the soles of the feet. Let there be given of the powder of Ammoniack, according to the description of Reverius, twice or four times in a day.

Take of humane skull prepared, of the seeds of Paony, of an Elks claw, of Pearls Powders prepared, each \mathfrak{z} β . of Amber greefe, *gr.* vi. make a powder; the dose vi. grains, in a spoonfull the Liquor hereafter described, three or four times a day.

Or Take of humane Skull prepared, of pearls each \mathfrak{z} β . of the Salt of Amber \mathfrak{z} i. of the Sugar of Pearle \mathfrak{z} i. the dose \mathfrak{z} β .

Or Take of the Spirit of harts-horn iii. drops, let it be given every sixth or 8th hour, in a spoonfull of the Julap below prescribed.

To the children of the poor, may be administred the *powder* of the *Roots* of *wild Valerian* ℥ss. to ℥i. let it be given twice a day, in a spoonfull of milk, or appropriate Liquor.

Untzerus greatly commends the Gall of a sucking whelp, to wit, that the whole juice of the gallie-Bag being taken forth, be given to the child to drink, with a little of the water of the *flowers* of the *Tile*, or *Line-tree*.

A learned Physitian lately told me, that he had Known many Cured with this Remedie: Besides, Empericks are wont to cause the bigger children, after they have drank the gall, to eat also the Liver of the whelp broyled.

Liquors.

Julaps, distill'd waters, and other appropriate Liquors, may be prepared, after the following prescripts.

Take of *black-Cherry water*, ℥ iii. of the *Antiepileptical water* of *Langius*, ℥ i. of perlate sugar, ℥ ii. mix them.

Take of the green *Roots* of the *male Paonie* cut into little peeces ℥ vi. of *Hungarian Vitriol* ℥ viii. of *humane skull* ℥ ii. of the *Antiepileptic water* of *Langius* half a pint, mix them, and let them be distilled in a glass retort, in hot sand, the dose i. spoonfull, to ii.

Take of the fresh roots of the *male Paonie* cut, ℥ iiiii. being brused in a Marble mortar, pour to them of Spanish-wine, lib. i. make a strong expression, add of *manus Christi* pearled, ℥ss. let it be kept in a close glass. The dose i. Spoonfull, or ii. twice in a day.

Convulsions
by reason of
breeding of
Teeth.

When Convulsive motions happen by Reason of the difficulty of breeding Teeth, this Symptom as it is secondary and less dangerous, so the Cure, does not always require the first or chief labour of healing, but sometimes we are rather carefull to remove it, by allaying the pain, and the feavourish Distemper, wherefore both the patient, and the nurse, oughr to use a slender, and refrigerating Diet; the Teeth being about to break thorow the Gums, their passage should be made easie, by rubbing or cutting them; and also *Anodynes* should be applied to those swelled, and grieved parts: Clysters and taking away blood are often used: it behoves to cause sleep, and to attemper the fierceness of the blood: some times antispasmodick Remedies are made use of, but the more temperate, and such as do not trouble the blood, and humors, Vesicatories, or Blistering plaisters, because they aptly evacuate the *serum*, too much poured forth on the Head, oftentimes bring help.

Spasms or
Convulsions
caused from
other occasions.

When Children are troubled with Convulsions, not presently after they are born, nor by reason of the cutting of their Teeth, but for other occasions, and accidents; the cause of such a Distemper, for the most part subsists, either in the head, or somewhere about the Viscera of Concoction. When the former is suspected, as it is wont to be manifested by signes which argue a *Serous Colluvies*, too much heaped up within the Head, the former Remedies, already recited, ought to be given, in a larger dose; besides, in those, who are able to bear purging, sometimes a Vomit, or a light purge is prescribed: *Wine*, and *Oxymel* of *squills*, also *Mercurius Dulcis*, *Rhubarb*, and *Resin* of *Jalap*, are of approved use.

As often as the Cause of the Convulsive Distemper seems to be in the *Viscera*, either Worms, or sharp humors, stirring up the torments of the Belly, are understood to be in fault.

By reason of
worms.

Against Worms, a purge of *Rhubarb*, or *Mercurius Dulcis*, the *Resin* of *Jalap* being added, is ordained: sometime past, a Child being miserably afflicted with Convulsions, that he seem'd to be just dying, I gave him a dose of *Mercurius Dulcis*, with *Resine* of *Jalap*; with his stools, which were four, he voided xii. worms, and presently grew well.

Take of the root of *Verginian Snake-weed*, in powder ℥ i. of *Corall Calcined* to a whiteness ℥ss. a powder ℥ i. the dose from half a scruple, to one scruple, twice in a day, continued for three days, drinking after it a decoction of *Grass-roots*. Take of the species of *Hiera* ℥ i. of *Venice-Treacle* ℥ ii. make a plaister for the bottom of the belly, or apply to the Navel, a plaster of *Galbanum*.

If the Convulsive motions are suspected to proceed from an irritation of the ventricle, and intestines, made by sharp humors, a gentle purging, either by vomit, or stool, or both successively ought to be instituted. For this end, let them drink, a gentle Emetick, of wine of squills, or salt of vitriol; when even the sick are troubled with a striving to Vomit of their own accord: but if the other Evacuation,

cuation, or down-wards shall seem better to be tryed, they ought to take an Infusion of *Rhubarb*, or the powder, and *Syrrop* of *succory* with *Rhubarb*, or of *Roses* with *agaric* and very often by these Remedies, timely applyed, I have seen the Convulsive Distempers in Children to be cured: besides in this Case, Clysters are frequently used: but external Medicines are not to be omitted; to wit, fomentations, oyntments, plaisters applyed to the Belly.

Take of the flowers of *Cammomel* cut very small, ii. handfulls, let them be put into two litle bags, made of fine Linnen, or Silk, which being dipped in warm Milk, and wrung out may be applyed successively to the abdomen, or lower region of the belly.

Take of the tops or flowers of *Mallows*, in like manner but small, let them be fryed in fresh butter, or hogs Lard, and in the form of a Liniment, or a Cataplasm, applyed to the Belly.

CHAPTER V.

Of Convulsive Diseases, of Ripe Age, arising chiefly by reason of the Nervous origine being affected.

Although Convulsive Distempers, which happen to those of riper years, being known by other Names, also are commonly reputed of some other stock, and are wont to be referr'd to the passions called Hysterical, Hypochondriacal, or Colical, or to the Scorbute; yet if the matter be a little better consider'd, it will easily appear, that some Convulsive Symptoms, both in Men and Women, do come from the Brain, which Convulsions properly and truly challenge to themselves the Name: But these (as we have already mentioned) may be distinguished after a various manner, by the manifold seat of the morbidick Cause, but chiefly into these three kinds, viz. Into Spasms or Convulsions stirred up, by reason of the origine of the Nerves being chiefly affected; into others being stirred up, by reason of the extremities or ends of the Nerves, being possessed by the morbidick matter; and lastly into such, from whose head the morbidick matter descending, fills the whole passages, or the most part, of some certain Nerves, or of all together.

Three kinds of Convulsions hapning to those of riper years.

Therefore, that we may proceed, to unfold the Convulsions, arising from the beginnings of the Nerves being affected, take notice here, that the morbidick matter besieging the beginnings of the Nerves, doth sometimes chiefly flow into the first pair of Nerves, to wit, which respect the Muscles of the eyes and face, and from thence the contractions, and tremblings, now of the Nose, Cheeks, or Lips, now of the Eyes, or the distortions of the mouth, follow. Secondly, sometimes the wandering and intercostal pair do chiefly imbibe the Heterogeneous particles; and then Inflations, or Contractions of the Abdomen, and Hypochondria, and also the palpitation of the Heart, trembling, difficult and interrupted breathing, an intermitting pulse, and other Symptoms of the middle, and lower Belly, do very much infest. Thirdly, but sometimes the morbidick Cause being placed lower, affects chiefly the spinal marrow, and therefore the outward members, and limbs, are rendred obnoxious to inordinate leapings forth, and contractions: Further, in very many Cases of this nature, because the Animal spirits being exposed about the origine of the Nerves, do inordinately leap back towards the *Encephalon*; for that reason, to all Convulsions almost being excited by this means, the *Vertigo*, also the scotomie or giddiness, the tingling of the eares, and sometimes the amased Insensibility or falling down of the Spirits, are joyned, or follow.

Distempers arising from the Nervous origine distinguished.

1. According to the various Nerves being affected.

But as we may Conjecture, from the various figures of the Convulsive distemper, it seems, that the Convulsive matter hauling those, or these nerves, or many of them together, is lodged either about their beginnings, only, so that the Spirits in that place being often exposed, a frequent and very troublesome *Vertigo* arises, besides tremblings, and a short faintness about the *Præcordia*, swoonings, and often leapings, and light contractions in the Viscera, or muscles are felt. Or Secondly, the explosive particles being dilated to the beginnings of the nerves, enter

2. According to the Various places of the same Nerves being affected.

ter more deeply into their processes, and not seldom being slid down into the nervous foldings, belonging to the Præcordia, or the Viscera of the lower belly, or also to the exterior members, procure there, other as it were nests of Convulsive distempers, that as often as the Spirits about the nervous origine, are driven into explosions, presently, fits as it were hysterical, asthmatical, or otherways Convulsive, arise in the Abdomen, Thorax, or Limbs: Examples of these, and by what means they are made, shall be anon more clearly delivered: In the meantime, the spasmodic matter, flowing into the pipes of the Nerves, when it is transfer'd even to their processes and remote enfoldings, yet, forasmuch as it hath still its chief mine about the nervous original, therefore after very grievous Convulsions of the Viscera or members, a great perturbation of the Brain follows thereupon, with a tingling of the eares, a vertigo, and often an Insensibility or amased excurtion of Spirits: but sometimes the morbid matter, as to the greatest part, being translated to the farthest ends of the nerves, from thence they become free or clear about their beginnings: For I have observed many, who, whilst at the beginning, they were infested with the vertigo, often fainting away with fear, head-ach, and heavynesse about the hinder part of the head, to have felt about the *Præcordia* or *viscera*, only light inflations, or tremblings; but afterwards, suffering more cruel Convulsions about these parts, they did not complain of the former distempers of the Head.

By what
means the con-
vulsive matter
flows into the
Nerves.

If it should be further demanded, concerning the Convulsive matter, from what place it should be brought, and by what ways carried towards the beginnings of the Nerves, and what kinde of Settlement, and as it were cherishing nests it there obtains; we say, that although we cannot detect the footsteps, and manifest passages of this matter, yet so much may be collected from certain observations, and the analogie of things, it may be supposed there are these two distinct manner of passages, whereby the Convulsive particles, being first poured out into the Brain and Cerebel, from the blood, are from thence carried towards the beginnings of the Nerves: *viz.* First sometimes this matter being imbibed by the Brain and Cerebel, and by degrees passing thorow the pores of either, slides into the Trunk of the oblong marrow, whose tract being also overcome by it, together with the nervous juice, it slides forward towards the original of the Nerves, and is heaped up neer their heads, or within the medullarie trunk it self, or within the annularie Prominencies, in which places, either a long while subsisting, it stirs up frequent *Vertigoes*, and more light Convulsions, in remote parts as hath been said; or being slid down from thence, more deeply into the passages of the nerves, excites fits of Convulsions very Cruel: such a progress of the morbid Cause, we suspect in whom the Vertigo, swooning, heaviness of the head, and torpor of the minde, go before the Convulsive assaults: Indeed, the matter of the disease, abounding as yet in the brain and marrowy Appendix, produces these kinds of previous distempers; which being slid down from thence, into the Nerves, causes Convulsions.

2dly, There is yet another way, whereby it plainly appears, that the material cause of the Convulsive Distemper, is transferred, to the beginnings of the Nerves; to wit, when the same being deposited by the *serous water* within the Cavities, or ventricles of the Head, it is insinuated into the Neighbouring roots of the Nerves: For in *Chronical* Diseases, when the remarkable discrasie of the blood and humours, happens also to be accompanied with a praved disposition of the brain, oftentimes a great plenty of sharp *serum*, infesting the Nervous stock, dropping forth from the Vessels of the *Choroëidan*, or retiform enfoldings, slides into the ventricles of the brain, and its Appendix: But this serous water, afterwards breaking thorow the under-spreading of the *Cerebell*, into the fourth ventricle, the little skin there being displaced, whereby the oblong marrow is uncovered, it falls upon the beginnings of one or more of the Nerves, and either by irritating, or imbuing them, with Heterogeneous and explosive particles, induces the Convulsive disposition. And this for the most part is the cause, that sick people, after long and ill handled Feavours, also after the more grievous *Cephalic* Diseases, at length dye of Convulsions; as I have found, by the frequent Anatomie of the Carcases, of those who dyed by that means. Also it appears by anatomical Observation, that the brain may be overflowed by a certain serous water, without the distemper of the Convulsive disposition; and further that in some, who

who dyed of the Epilepsie, and other Convulsive diseases, there was no deluge of the *serum*, within the ventricles of the brain: By which it is given us to be understood, that the Convulsive distempers, do not flow only from the watery matter in the Head; but that they arise not at all from such a cause, unless the *serous* water, overflowing the *ventricles* of the Brain, and chiefly that underlaying of the *Cerebel*, be imbued with heterogeneous and explosive particles. I remember once, my Council to be ask'd for a young man labouring with an Egregious Phtisis, and at that time truly desperate, besides a cough, and shortness of Breath, he had grievously complained for many days, yea weeks, that he could not lye upon his back in his Bed, or whilst he sat in a chair, he could not lean his head backwards: for that by this, or that posture of his Body, he was wont presently to suffer tremblings of his heart, and a fainting of the Spirits, as if he were just about to dye: wherefore of necessity he was fain to hold his head upright, or leaning forward. After he was dead, his carcase being dissected, his Lungs appeared all over tumified, and in some places Ulcerated: then his Skull being opened, there flowed within all the *Ventricles* of the brain, a great quantity of yellow and salt *Serum*: which water certainly whilst it did slide forward upon the fourth *Ventricle*, about the Trunk of the oblong marrow, his head leaning back, rushing upon the heads of the wandering, and intercostal pair of nerves, did stir up the aforesaid Convulsions about the *Præcordia*: but so long as his head was inclined forward, that the heap of *serum* flowed back into the anterior *Ventricles* of the Brain; the origine of the nerves remained free from that Convulsive matter.

Having hitherto shown, how many ways, and by what passages, the morbid matter, being dilated towards the origine of the Nerves, seems to bring on Convulsions, it were easie, according to these reasons, to unfold many Convulsive Symptoms: for besides the Convulsive motions of Infants, and children, oftentimes excited from the same kinde of Causes, hither may be referr'd the Contractions, and sudden leapings forth of the nervous parts, which follow upon feavours. As also those passions commonly called *Hysterical*, also *hypocondriacal*, and certain others, proceed not seldom from the *morbific* Cause, rushing upon the beginnings of the Nerves. We will therefore endeavour to establish the truth of this *Hypothesis* by some other Histories, and examples, of Sick people; but in the first place, we will propose observations of that Kinde, in whom the morbid matter, settling upon the beginnings of the nerves, and not being as yet slid deeply into their processes, induced frequent *vertigos*, and only more light Convulsions, of the *Viscera* and *Præcordia*.

A noble woman about 30. years of Age, of a tender Constitution, and lean in Body, was wont every winter to be grievously afflicted with a *Catarrh* or Rhume, flowing upon the wind pipe, and Lungs, with a hoarse Cough, and great spitting, but the last year, great care and diligence being used, she avoyded that evil. But after the winter Solstice, having taken cold, she was troubled with an huge pain of the head, a tingling of the ears, a giddiness, with a great defluxion upon the eyes, that it easily appeared, that the heap of *Serum*, which before this time was wont to distill into the Breast, was now wholly layd up, within the head and Brain: besides, an effect of which was, that as often as she began to sleep, she was greatly infested with passions, as it were *hysterical*, to which she had never been before obnoxious: For when ever being sleepy she closed her eyes, presently a bulk ascending in her belly, a choaking in her throat, tremblings, and leapings about the *Præcordia*, were stirred up; which Affections notwithstanding quite ceased, when she was thorowly awakened, so that the Sick party was necessitated, to abstain almost altogether for many days and nights from sleep.

Being sent for to this Lady, after she had bin sick and weak for many days, I was compelled at length to use gentle medicines: Therefore I took care, that blood should forthwith be drawn from the foot, to four ounces; and every day a Clyster of milk and sugar to be administred, by which she was wont to have three or four stools: besides I gave her every eighth hour a dose of the Spirits of *Harts horn* in a Spoonfull of the following Julap. Take of the water of *penny-royall*, of *walnuts*, and *black Cherries* each ζ iii. of *Hysterical water*, ζ ii. of the Syrrup of *Clove-gilliflowers* ζ i β . of *Caster* tyed in a little knot, and hang'd in the middle of the glass ζ β . of the powder of *Pearls* \mathfrak{D} i. mingle it. I Caused with success, a *vesicatorie* to be put behinde the ears; and a *Cataplasm*, of the leaves of *Rue* and *Cuccurbit*,
F
pint,

pint, with the *Roots of Bryony*, *bay salt*, and *black soap*, to be layd to the soles of her feet. Sometimes I gave her in the evening, in a little draught of the prescribed Julap, half an ounce of *Diacodium*, to which succeeded a moderate sleep, without the wonted Convulsions following: which kinde of effects, from opiats exhibited in the like case, I have often experimented: for the quenching her thirst, I gave her a *Ptisan*, with diuretick Ingredients boyled in it: by the use of these, she was very much eased, in a short time. But what proved a great benefit to her was, that an Imposthume in her ear, breaking of its own accord, powred forth, at first a yellow matter, and afterwards for many days, a great plenty of thin *Ichor* or *Excrement*, by which Evacuation, the Convulsions of the *Viscera* and *Præcordia* wholly ceasing, the disease was perfectly Cured.

As to the Reason of the aforesaid sickness, without doubt it seems, that those Distempers were excited, by the ferous colluvies, layd up within the Bounds of the Head: for the translation of that humour into the head, brought at first both the Disease, and the Secretion or flowing of it out, thorow the Emunctuaries of the ear, took away all the Symptoms: Besides, when the morbid matter had brought in to the Spirits, planted about the beginings of the nerves, a Disposition somewhat explosive, they, though being struck as it were with madness, they were continually troubled, yet so long as leaping back towards the Brain, they obtained a space, in which they might be more freely expanded or stretched forth, they did indeed only more vehemently exercise the Phantasie, and without farther trouble did only cause watchings. But, when by sleep sometimes Creeping upon her, the excursion of the unquiet Spirits were restrained towards the Brain, (which indeed necessarily happens, when we sleep, the nervous Liquor within the pores of the brain, at that time being more plentifully admitted) they tumultuarily rushing upon the heads of the wandring pair, and intercostall Nerves, troubled the whole series of Spirits, flowing within the passages of those Nerves, and so caused the aforesaid Convulsions, about the *Præcordia*, *Viscera*, and muscles of the Throat. I have known many both Men and women sick after this manner, who, when they have been troubled with an headach, an heaviness of the hinder part of the head, or a *Vertigo*, have while they slept, felt forthwith in their *Præcordia*, or *Viscera*, or in both together, perturbations as it were Convulsive; which indeed happens from the bending downward of the tumultuating Spirits, being reflected from the brain, upon the beginings of the Nerves: But that the use of opiats, brought a pleasing sleep to this sick person, without the wonted Convulsions, following, the reason was, because the animal spirits, as unquiet and furious as they were, yet by the Intanglement of the narcotick Particles, they were bound as it were in chains, that afterwards, without any resistance they were overcome by sleep. I have indeed very often happily cured, most grievous fits of Convulsions, both Asthmatical, and as it were hysterical, by administering Opiates.

2. *Observation.* An honest woman M. G. of 67. years of Age, yet of a florid countenance, and fat in body, when she had been a while obnoxious at first to a swelling of the face, and very grievous fits of the headach, she fell through the great cold of the winter, into a very troublesome *Vertigo*, with a trembling of the heart, a fainting away of the Spirits, and a frequent striving to vomit: being lay'd in her bed, if she opened her eyes, or turn'd her from one side to another, she was presently troubled with a notable gididness, or swimming in the head, with swooning, and effectless vomiting. Visiting this woman, I doubted not, but that the cause of her sickness was, the Convulsive matter, being translated from the exterior region of the head, to the most inward recesses of the *Encephalon*, by whose inspiration or heterogeneous *Copula*, the animal spirits being, touched while they leaped forth inordinatly towards the brain, they excited the vertiginous Distemper, and while they rushed tumultuarily upon the heads of the nerves, the Scotomic, disorder of the *Præcordia*, and endeavouring to vomit. A large Vesicatory or blistering Plaster, being applyed to the nape of the neck, and behind her ears, Clusters daily administred, also the use of *Spirits of harts-horn* frequently, and of a Cephalick Julap, cured her within a few days.

3. *Observation.* A noted man, about 34. years of Age, when he had been for a long time subject to a Cough, with great and thick spitting, besides having the pores of his skin very open, he was wout to sweat continually, and every night to be wet with it:

it : about the begining of the spring, he perceived those usuall evacuations to happen more sparingly ; in the mean time, he Complained of a fullness of his hands and feet, and as it were a certain swelling or puffing up, so that he feared a dropſie was coming upon him ; beſide he was troubled in his head with a giddineſſe, and frequent *Vertigo* : A little while after, this evill increaſing, light contractions, and ſudden Convulſions, were ordinarily excited, about his Lips, and other parts of the mouth and face ; alſo preſently after (the morbiſic matter as it ſhould ſeem, flowing upon the beginnings of the wandring pair and intercoſtal nerves) he was afflicted with the trembling, and leaping of the heart, with frequent fainting away of the vital ſpirits, as if a *Leipothymy* or ſwooning was falling upon him.

I know that very many aſcribe theſe Convulſive paſſions, ſo grievouſly infeſting the *Præcordia*, to the vapours riſing from the ſpleen : but it ſeems much more reaſonable, to deduce them from the Convulſive matter layd up within the brain, and ruſhing upon the beginnings of the Nerves ; becauſe a ſhifting or tranſlation of ſome excrements, from ſome other parts, to the head goes before, and that it is ſo layd up, within the compaſs or bounds of the *Encephalon*, the almoſt continual vertiginous diſtemper, and the Convulſions of the parts of the mouth, and face, teſtifie it plainly : wherefore I thought good to preſcribe to this man, Remedies, according to the method hereafter ſhown.

I might be able here to propoſe many obſervations of this nature, in whom the morbiſic matter, ſubſiſting neer the beginnings of the nerves, ſtir up light Spasms or Convulſions, only of the *Viſcera* or members, with a *Vertigo*. But becauſe a portion of this matter, deſcending from the head, enters more deeply the pipes of the Nerves, and ſo ſtrows the tinder or enkindling of exploſive ſeed, as it were gunpowder, about their middle and ultimate proceſſes and enfoldings, it will be to the purpoſe, to add ſome examples of this kinde.

A certain young maid E.L. tall and haſome, ſprung from ſound parents, and her ſelf (as far as might be Perceived) originally healthfull, after ſhe had ſerv'd a maſter long ſick, being a long time and almoſt continually with him, and was forced to watch whole nights very often, and alſo at other times, ſo that ſhe never ſlept but ſhort and interrupted naps ; ſhe at length begun to complain of an heavineſs in her head, and a frequent *Vertigo* : within a little time after, the diſtemper growing worſe, ſhe felt tremblings in her whole body, with a light ſhaking of her members, which came at certain times, though wandring and uncertain : afterwards ſhe ſuffer'd fits plainly Convulſive, and thoſe horrid, and often infeſting : a little before the approach of the diſeaſe, ſhe was afflicted with a ſhort *Scotomie*, or ſwimming in her head, by and by ſhe felt a ſtreightneſs, and great oppreſſion of her Breſt, whereby all her *Præcordia* were drawn together : then preſently gnawing her teeth, and giving a great groan, ſhe was wont to fall to the ground ; in the mean time, ſhe was ſenſible, but labouring with the great oppreſſion of her heart, till that conſtriction of her breſt was looſened, ſhe was not able by any means to riſe : afterwards, when the fit was paſt, ſhe was diſturbed a good while, with a great palpitacion of the Heart, an heavineſs of the ſenies, and a great debility of the animal function. After that this Sick maid had liv'd ſubject to theſe kinde of fits, being very often repeated, for about 14. months, ſhe at laſt became Epileptical, that as often as the aſſault of the evill returned, being flung proſtrat on the Earth, ſhe was taken with the inſenſibility or amazedneſs of Spirits, with the foaming at mouth, and other peculiar ſymptoms of the falling-ſickneſs. Neither did this diſtemper ſtay here, but ere the ſpace of a year was elapſed, it degenerated into madneſs, that at laſt, the ſick maid, having loſt the uſe of her Reaſon, grew ſometimes mad with fury, and ſometimes was plainly ſtupid and fooliſh.

It is plain, from the beginning, progreſs, and often *metamorphoſis* of this Diſeaſe, that it at firſt, had its cauſe, and ſeat in the head, near the beginning of the nerves, and from thence, did dayly unfold more largely its bounds, both into the brain, and into the nervous System ; for from the beginning, the morbiſic matter, conſiſting neer the beginnings of the nerves, Cauſed only lighter Spasms or Convulſions, of the *Viſcera* and members, and ſhakings, with the *Vertigo* ; afterwards, a portion of it being ſlidden into the pneumonic nerves, and their foldings, produced moſt grievous Convulſions of the *Præcordia*, *Diaphragma*, and *Ventricle* ;

and also another portion of the same matter invading the Brain, and its marrow, caused the Insensibility or amazedness, and so the fits of the Falling-sicknesse ; and at length, the texture of the spirits being wholly vitiated, and their *Latex* being degenerated into a most sharp, and as it were Stygian Liquor, the convulsive distempers pass'd into madness.

Therefore, as to the particular reasons, both of the disease, and symptoms, it seems, that the aforesaid Virgin, by her sedentary Life, (she being deprived altogether of the exercise of the body, and the use of a more free Air,) but chiefly by her nightly watchings, and being frequently interrupted of her sleep, she had contracted a vitious disposition of the blood, and humours, and also a praved and weak constitution of the brain, and Nervous stock (to which may be added, that she did perpetually attend on a master, sick of most grievous distempers of Convulsions, and by that means, had received perchance some contagion, or convulsive Infection : And first of all indeed, the Heterogeneous particles being poured forth, together with the nervous juce, into the brain and Cerebel, and there cleaving to the spirits, as it were skirmished with the preliminarie scotomie, and vertigenous distemper ; then the convulsive matter, settling upon the beginnings of the wandring pair and intercostal Nerves, and the spinal marrow, brought in, with the Vertigo, the leaping of the *Viscera* and Muscles, and their lighter shakings : Afterwards, when entring more deeply the pipes of the Nerves, it was carried into the Cervicall, and Cardiac, and perhaps intercostal, and other unfoldings, and embued the spirits, performing the office of respiration, and the pulse, with an explosive *Copula* ; they being brought into explosions at every turn, together with their superiors, inhabiting the nervous origine, by reason of fullness, or because of irritation, excited most horrid Convulsions of the respective parts : But the fit growing strong, from the pneumonic or breathing Nerves being strictly bound, the sudden inordinate systole of the Thorax, was stirred up ; then presently, the *Diaphragma* being suddenly, and vehemently drawn back, the obstreperous ejulation did succeed : Further, when by reason of the systole of the Thorax, being sometime continued, the blood being hindred, that it could not move, it *stagnated* altogether in the *præcordia*, therefore, during the fit, that great oppression of the heart, with want of speech and motion afflicted the sick maid : But in the mean time, while as yet the region of the brain remained free, and clear from the explosions of the spirits, the sick party remained in her senses, or memory : but afterwards when the Convulsive matter being dayly increased, it was unfolded in the middle or marrowy parts, of the debilitated and broken brain, to the former passions, about the *præcordia*, came also the Insensibility and amazedness of spirits, then the Epilepsie, and lastly madness, for the reasons before recited. Many medicines, and of various kinds, being prescribed to this sick maid, by many, both Physicians and Empericks, but confusedly, and with an uncertain method, being presently changed, did her no good.

§. Observation.

A certain fair woman, well coloured, and well flesh'd, from a settled grief, fell into a sickly disposition ; about noon, and the evening, for the most part she was pretty well, but in the morning, when she had slept enough, and often indulg'd it too much, till she became very somnolent and heavy : being thorowly awakened, presently she was wont to complain of a heaviness, and as it were a stupidity, in her whole head, with a *Vertigo* at every motion, or stirring about of her head ; a little after she constantly expected a convulsive fit, or the insensible amazedness of the spirits, and sometimes this, sometimes that, was wont to infest her : for that after the *Vertigo*, as it were a *prævious velitation*, for the most part, she felt in her ventricle, and left side, an heavy or weighty pain running up and down here and there ; hence belching, a striving to vomit, eruptions of blasts, also wonderfull distentions of the abdomen, and hypochondria, did follow, and sometimes for many hours, did miserably Exercise this woman ; but sometimes these Symptoms hapned to be wanting, and then the distemper more cruelly afflicted her brain : for falling into frequent insensible fits, she was wont to continue a great while immovable, and with her eyes shut, without sense or understanding ; and when her servants had moved her, by rubbings, and with the fume of Tobacco, she came by and by to her self, but presently again she fell into the like insensibility, and so for four or five times, before she could perfectly recover her self, and be without expecting to fall into these fits again : At length the Tragedy being acted,

acted, she remained however affected with an heaviness, and torpor of her head, in some measure: but about noon, all the clouds being dissolved, she was wont to obtain a fair, and serene disposition of her whole head; untill the next morning; the same Symptoms would return again.

Who shall rightly weigh these Symptoms, need not suppose them vapours, arising from the womb, or spleen, and in those seek for the morbid cause in vain: which truly may more certainly be placed in the head it self: for it seems, that by reason of a great sadness (which happens often to women) at the beginning, a great debility, together with a vitious taint, was impressed on her brain; so indeed that the animal spirits derived to the brain and Cerebell, brought with them, heterogeneous particles, of a mixt kinde, *viz.* Partly narcotick or stupifying; and partly explosive or rushing forth: which kinde of Copula, when they had more plentifully conceived, through sleep, they were stirred up to the shaking of it off, by mere fullness: as soon therefore, as the woman was awakened, the same spirits, being moved, either a bending downward being made below, they were depressed upon the beginnings of the Nerves, and there being exploded, they excited Convulsions of the *viscera*; or leaping back towards the middle of the brain, and being there struck off, they brought in those frequent and terrible Insensibilities. In truth, this distemper was somewhat akin to the Epilepsie, but that the morbid matter was not as yet stayed within the regal palace of the brain, or its middle part, so that there it might infect the spirits, within their Fountains; but yet, the same heterogeneous Copula, did cleave more strictly to them, dissociated or disjoyned below, and dividing themselves into various and lesser rivolets, according to the beginnings of the Nerves. In the mean time, the spirits, whereby they might shake off that matter, being often exploded, caused the stupor, and Insensibility, but bending to some other place, they rushed upon the beginnings of the Nerves, for that reason caus'd those Spasms or Convulsions of the *viscera*: But that the fits come only in the morning, after a plentiful sleep, the reason was because the heterogeneous Copula of the spirits, coming to them with the Nervous juce, was at that time gathered together to a fit fulness for explosions, which being then wholly shaken off, the sick person remained therefore all the rest of the day, free from the distemper, till the next day, when the nights sleep had brought to the head, a new supplement of morbid matter, the like fit returned in the morning; which perhaps, as the sleep had been shorter or longer, was moved now within the brain, now near the nervous origine.

But it may be observ'd, that Convulsions have arisen, from the nervous origine, being chiefly affected, not only in the female sex, as the weaker and more lyable, but sometimes, these kinds of distempers have been excited in men, from the like *procatartick* cause. Some years since, being hastily sent for from a stranger, who lodged in this Citty, at first sight, I suspected that he was possess'd, and believ'd that he had more need of Exorcisms, than of Medicines. He was about Forty years old; who had now for about three years, at certain set times of the year, been wont to be troubled with convulsive Motions; whilst he by chance lodg'd here, for a few days about his occasions, by reason of a great sadness, he had a fit of his sickness greater than usuall: He was wont for two or three days beforehand, to feel the coming of his disease; to wit, from a great commotion within the forepart of the head, almost a continual *Vertigo*, and frequent dimness of his eyes: But the fit coming on him, at first his eyes were variously roled about, and inverted, then a certain bulk, like a living animal, was seen to creep from the bottom of his belly upwards, towards his heart and breast, and from thence to his head: I my self pressing his belly, with my hand, felt very plainly this kinde of motion, and as long as I hindred this round thing from ascending, with both my hands, and all my strength, he found himself indifferently well; but as soon as this swelling creeping upwards by degrees, had reached the head, presently the members of the whole body were cruelly pull'd together, that he would dash himself against the walls, or posts, as if possess'd by an evill spirit; He could hardly be held, and restrain'd, by four strong men, with all their force, but that he would leap from them, and sling out his arms, feet, and head, here and there, with divers manners of motions: when he ceased from leaping forth, or struggling, his members would be strongly extended, and his muscles stiff, as if troubled with the Cramp, or stiff extension: such a fit would last about a quarter of an hour, then coming

An Observation of a distemper as it were hysterical in a man.

coming to himself, he would talk soberly, and walk about in his Chamber ; he knew what he had suffer'd, and ask'd pardon of the standers by, presently after he began to draw his eyes inward, and swiftly to role them about : then presently the convulsive distemper returning, acted the like Tragedy as before : and after this manner, he would have five or six of these kinde of convulsive fits, within three hours space. In the midst of one of these fits, a vein in his Arm being opened, and a large orifice made, the blood flowed out slowly, and was seen presently to be congealed : and so indeed, that being received into the dish, it did not flow about, after the manner of Liquors, with a plain and equal *superficies*, but like melted sewet, drop'd into a cold vessell, one drop being heaped upon another, it grew to a heap.

*The reason of
the aforesaid
Case,*

If this strange distemper had hapned to a woman, it would presently have been said, that it was the mother, or hysterical, and the Cause of it would have been laid on the fault of the womb ; especially, for that the ascent of something, like a bulk, began the fit, from the bottom of the belly : But when this common solution, which most often is the mere subterfuge of Ignorance, cannot be admitted in this case, it seems most congruous to reason, to referr all these Symptoms, to the evill affections of the brain, and nervous stock. For truly it may be plainly gathered, that the cause of the disease, did lye hid in the head it self, by the Symptoms preceding the fit, which did denote a very great agitation of the spirits, within the head ; that inflation of the brain, and heavy swimmings, which constantly came just as the fit was coming upon him, the turnings of the eyes, manifestly argue, that heterogeneous and explosive particles, did adhere to the spirits, dwelling within the *Encephalon*, near to the beginnings of the Nerves. So that this case, comes near to the nature of the Epilepsie, excepting, that the spirits within the middle of the brain, did not admit an heterogeneous Copula, nor being exploded in another place, did they tumultuously break forth there ; for during the fit, the sick person was still in his senses, or had the use of his memory : But the morbid matter, being more plentifully laid up in the head, when from thence it was slid, more deeply into the pipes, both of the Interior und Exterior Nerves, it had placed mines of explosive seeds, very diffusive, in the *viscera*, both of the lower and middle belly, and also in the exterior members ; so that, when the animal spirits began to be exploded, near the beginnings of the nerves, presently from thence, others inhabiting the mesenteric enfoldings, and then others in the other nervous enfoldings, interjected from the outmost bound, even to the head ; being exploded in order, did even continue the Convulsions, from one part to another, untill they came to the head it self : but presently the explosion being translated from thence, to the spirits dwelling in the spinal marrow, and Appending Nerves, the most strong Convulsions of the muscles, and members of the whole body follow'd : But that, that ascent, as it were of a bulk, or substance which very often was perceived in the lower belly, about the beginning of the Convulsions, proceeding from the spirits, within the mesenterick enfoldings, being brought into explosions, shall be more largely declared anon, when we come to treat of hysterick passions.

*Wherefore the
Convulsions
begin from the
extremities of
the Nerves.*

In the mean time if it be ask'd, for what reason, that, the convulsive paroxysm, beginning in the part of the head, near the beginnings of the Nerves, presently the spirits dwelling in the outmost parts (as many as are pre-disposed for that Symptom) enter into explosions, and so transfer the convulsive Distemper, being there fully raised, upwards, (for it is for the most part so, whether the entrance of the disease begins in the bottom of the belly, or about the middle of the abdomen, the *Hypochondria* or *præcordia*, for that the Convulsion is wont to creep by degrees, from those places towards the head.) I say, for the solution of this, these two considerations are offer'd, to wit, in the first place we consider, that when some whole *series* of spirits is disturbed, those who reside in the extreamest bounds are first destituted of their originall Influence ; wherefore, they, before others, grow tumultuous, and begin to grow irregular ; hence it is, when the Nerve of the arm or thigh, is strained hard, by leaning on it, that the wonted Influence is hindred, that a numbness, with a sense of pricking or tingling, is first felt in the fingers or toes ; from whence by degrees, it creeps upwards towards the places affected. Secondly, the other is, and rather the reason of this distemper, to wit, that the spirits being ready for explosions, when they are contained with-
in

in the nervous pipes, one or more, as so many distinct little Tubes, they require a sufficient ample space, in which they may be able very much, and indeed successively to be rarefied, and expanded; which thing because it cannot be easily performed, within the Trunks of the Nerves, from the beginning towards the end, therefore while the Spirits, about the nervous origine, being first struck off, leap back towards the *Encephalon*, for that cause they stir up the Vertigo: the more open explosion of the spirits, for the most part, begins about the inferior passages of the nerves, or at their extremities, where the Trunk of the nerve is either dilated, into more ample foldings, or terminated in more *fibres* largely dispersed abroad; then those Spirits being exploded, there is room made presently for others succeeding in order, whereby in like manner they may be exploded: Hence we may observe, whilst the exterior Spirits are exploded, if a Ligature or hard Compression being made, the succession of others into the same space, or their progress toward the exterior parts be intercepted, the Convulsion is wont to be hindered, that it cannot ascend upwards: wherefore when a numbness (as medical Histories testifie) being arisen from the farthest end of the finger, or toe, creeps to the superior parts, with a tingling, or like a cold air, and at length reaching the brain, causes most horrid Convulsions; if by and by after the motion is begun, the Arm or thigh be strongly tyed, the Spasm or Convulsion not being able to get over the bound place, is hindered from coming to the head; yea, it is usuall for hysterical women, as soon as the swelling of the belly, or the ascent of the bulk in the *abdomen* is first perceived, to gird strongly their waists, with Swathing-bands, and so oftentimes they prevent, the *Præcordia*, and the region of the brain, from being disturbed, by that same Convulsive Fit.

But that the Blood, being let out in the midst of the fit, was so soon congealed, indeed it very ordinarily happens to be so, in Convulsive and Apoplectical Distempers, as the most learned *Heighmore* hath first noted, out of *Hendochius*: But that some from hence contend, that Convulsions rely altogether upon the thickness of the Blood, and stagnation, its motion being hindered, cannot be granted: Because, the blood taken from those who are subject to convulsions, a little before the fit, is dilated with *serum*, and fluid enough: wherefore, we may lawfully think, that, that Congelation is caused by the *paroxysm* it self, because in Convulsive motions, and immoderate Contractions of the Nerves, and *Viscera*, the interflowing Blood, by the exhalations of its spirit, and *serum*, is somewhat loosened in its mixtion, and therefore in some sort coagulated; like as when milk, by reason of too much agitation, and separation of the parts one from another, grows into butter; wherefore this kinde of Coagulation of the Blood, seems rather to be the effect, than the Cause of the Convulsions.

Wherefore the blood is soon congealed in convulsive distempers.

The Curatorie Method.

AS to the Cure of these kinde of Convulsive Distempers, which in women, or Men, proceed from the morbid cause lying upon the beginnings of the Nerves. The first Indication will be, to draw away the tinder or inkindling of the disease, *viz.* to hinder, that the blood may not affix on the head, the heterogeneous particles, either begot in it self, or received elsewhere from the *Viscera*. For this purpose, an evacuation, both by catharticks, and blood-letting, unless something contradict, is wont to be beneficially prescribed.

Vomiting most often brings help, wherefore Emeticks of the Infusion of *Crocus metallorum*, or of the Salt of *Vitriol*, or wine of *Squills*, is to be taken at the beginning. Then almost the next day, the taking away of Blood, either by *phlebotomy* in the Arm, or by Leeches in the Sedal veins, is to be performed; then afterwards, a gentle purge of pills, or solutive Apozems, is to be ordained, and timely repeated.

Emeticks

Take of the pills of the *Amber of Crato*, or of the *Tartar of Bontius* 3 ii. of the Resine of *Jalap*, gr. xvi. of *Caster* ʒ i. of the oyle of *Rosmary* or *Amber*, ʒ ss. of *gumm-Ammoniac* dissolv'd in hysterical water, what will suffice to make 16. pills. Let 4. of them be taken every sixth, or Seventh day.

Purges.

Take of the *Roots of Polypodia* of the *Oak*, of sharp pointed-docks prepared, of *Chervil*,

chervill, each, ʒ vi. of the *male Paony*, ʒ iii. of the leaves of *Betony*, *germander*, *Chamipits*, *Vervine*, the *male Betony*, each i. handfull, of the seeds of *Cardamums*, and *burdock* each ʒ iii. let them be boyled in 4. pints of Spring water till half be consumed: Let it be strained into a matrace, to which put of the leaves of the best *Senna*, ʒ i. of *Rhubarb*, ʒ vi. of *Turbith* gummed ʒ ʒ. of *Epithimum*, of *yellow-Sanders*, each ʒ ii. of the Salt of *wormwood*, and *Scurvy-grass*, each ʒ i. the yellow rine of the *Orange* ʒ ii. let them digest close, shut, in hot Sand for 12. hours. let the straining be kept for use, sweeten it (if there be need) with what will suffice, of the *Augustan Syrrap*, or of *Succory* with *Rubarb*. The Dose ʒ vi. once or twice in a week.

Every day, in which purges are not taken, Remedies strengthening the brain, and also the animal Spirits; for the taking away the heterogeneous *Copula*, or for the hindring them from running into explosions, are to be administred, which indeed ought to be prescribed and chosen, according to the Constitution, and habit of the Body, and temperament of the sick; for too lean bodys, and such as being indued with a more hot blood, medicines less hot, and which do not trouble the bloud above measure, ought to be given: On the Contrary, for phlegmatick and fat people, whose urine is thin, and watery, and whose Blood is Circulated more heavily, and *Viscera's* stuffed, more hot Remedies, and notably apt to ferment the humours, are designed. In the former Case, let it be prescribed, after this manner.

Remedies for a
more hot tem-
perament.

Take of the *Conserve* of the *Flowers of Betony*, *Tamarisk*, the *male-Paonie*, each ʒ ii. of the *Species of Diamargerit frigida* ʒ iʒ. of the powder of the Root of *Paonie*, and of the seeds of the same each ʒ i. of *red-Corall* prepared ʒ ii. of *vitriol of steel*, ʒ ii. of the Salt of *Wormwood*, ʒ ii. with what will suffice of the juce of *Oranges*, make an *Electuary*, take of it twice or thrice in a day, drinking after it a little draught of the *Julap* hereafter prescribed.

Powders.

Take of *Corall Red*, with the juce of *Oranges*, beaten together in a glass, or marble mortar, and dry'd, ʒ ʒ. of the powder of *wisletow* of the *oake*, of the root of the *male Paonie* ʒ ii. of *perled sugar*, ʒ iii. make a powder, the dose from ʒ i. to ʒ ʒ. twice or thrice in a day.

Take of the *Species of Diamargarit frigida* ʒ ii. of the Salt of *wormwood*, ʒ iii. of the root of *Cocowpint* powderd, ʒ i. mix them, make a powder, let it be divided into xx. parts, take a dose in the morning, and at four in the afternoon.

Take of the *Roots of Butterbur* ʒ i. dose ʒ ʒ. to ʒ i. twice in a day.

Distilled wa-
ters and Fu-
laps.

Take of the *Leaves of Burdock*, and *Cocowpint* each vi. handfulls, let them be cut and mixed together, and so distilled. The dose ʒ ii. to iii, twice or thrice a day, after a dose of *Electuary* or powder.

Take of this water distilled ii. pints, of our *steel* prepared, ʒ ii. mix them in a Vial, let it be taken after the same manner.

Take of the Simple water of *walnuts*, and of *black-Cherries* each half a pint, of *Snales* ʒ iii. of the Syrrap of the flowers of the *male Paonie*, ʒ ii. the dose ʒ iʒ. to two, after the same manner.

Take of the *shavings of Ivory*, and *harts-horn* each iii. drams, of the roots of *Chervill*, *burdock*, *Valerian*, each half an ounce, of the leaves of *Betony*, *Chamepits*, *harts-tongue*, the tops of *Tamarisk*, each one handfull, of the barks of *Tamarisk*, and of the *woody nightshade*, each half an ounce, let them be boyled in two quarts of spring water, to the consumption of the third part; add to it of *white-wine* eight ounces, strain it into a pitcher, to which put of the leaves of *brook-lime*, and *Cardamine*, each one handfull, make an Infusion warm, and close for four hours: Let the colature be kept close in glasses. The dose ʒ vi. twice in a day, after a dose of some solid Medicine; sometimes such an *Apozme* may be mixed with ʒ ii. of our *steel*, and taken in the same manner.

In the Summer time, the use of *spaw-waters* is convenient, and for want of them, our Artificial ones may be taken.

Remedies in a
more cold tem-
perament.

If that for the reasons above-recited, more hot Medicines are to be prescribed, you may proceed according to the following method.

Take of the *Conserves of Rosemary*, of the yellow of *Oranges*, and *Lemmons*, each ʒ ii. of *Lignum aloes*, of *yellow-sanders*, of the roots of *snake-weed*, *Contrayerva*, *Angelica*, *Cocowpint*, each ʒ i. of the *vitriol of steel* (or of *steel* prepared) ʒ iii. of the Salt of *wormwood*, and *Scurvy-grass*, each ʒ i. with what will suffice of *candied Wall-*

nuts,

nuts, make an Eleſtuary : Let it be taken twice in a day, to the quantity of a nutmeg, drinking after it a doſe of appropriate Liquor.

Take of the *Roots of male-Paony, Angellica, and red Coral* prepared, each \mathfrak{z} ii. of *Sugar* diſſolved in the water of *Snails*, boyled to the conſiſtency of Tablets, \mathfrak{z} vi. of the *oyle of Amber* lightly rectified, \mathfrak{z} β . make a ſufficient quantity of *Lozenges*, each weighing about half a dram, take one or two twice or thrice a day, drinking after it a doſe of proper Liquor. Tablets.

Take of the *Roots of Virginian Snake-weed, Contrayerva, Valerian*, each \mathfrak{z} ii. of *red Coral*, and prepared Pearl, each \mathfrak{z} i. of *winteran Bark*, and of the root of *Cretian Dittany*, each \mathfrak{z} i. of the *Vitriol of Steel*, and Salt of *wormwood*, each \mathfrak{z} i. of the extract of *Centaury* \mathfrak{z} ii. of *Ammoniacum* diſſolved in hitherical water; what will ſuffice, to make a pillulary maſs : of which take four pills, in the morning, and at four in the afternoon. Pills.

Take of the *Spirits of harts-horn, or Sut, or humane Blood, or of Sal ammoniack*, what will ſuffice, take of them from 10. to 12. drops, morning and evening, in a ſpoonfull of Julap, drinking a little draught of the ſame after it. Spirits.

Take of the *Leaves of Betony, Vervine, Sage, Lady-smock, Cocowpint, Burdock*, each two hand-fulls, of *green wallnuts*, number 20. the rinds of ſix *Oranges*, and of 4. *Lemons*, of *Cardamums*, and *Cubebbs*, each \mathfrak{z} i. being cut and bruſed, pour on them of whey made of *Cider* or *white wine*, ſix pints, let them be diſtilled according to Art. The doſe \mathfrak{z} ii. or iii. twice in a day, after a doſe of a ſolid medicine. Add to i. quart of this liquor ii. drams of our *Steel*. Diſtill'd waters.

Take of the *Water of Snails*, and of *earth-worms*, each \mathfrak{z} vi. *walnuts ſimple*, \mathfrak{z} iiiii. of *Radish Compound* : \mathfrak{z} ii. of *white ſagar* \mathfrak{z} ii. make a Julap. The doſe 4. or 6. ſpoonfulls, twice in a day, after a doſe of a ſolid medicine.

Take of *millipedes* or *cheſſlogs*, cleaned, i pint, of *Cloves* cut, \mathfrak{z} β . put to them i. quart of *white-wine*, let them be diſtill'd in a glaſs-Cucurbit. The doſe \mathfrak{z} i. to \mathfrak{z} i β , twice in a day.

For poor people, medicines eaſie to be prepared, may be preſcribed after this manner.

Take of the *Conſerves of the Leaves of Rue*, made with an equal part of *sugar*, \mathfrak{z} vi. take of it the quantity of a nutmeg, twice in a day, drinking after it of the decoction of the *Seeds and Roots of Burdock*, in whey or puffed-drink made of *white-wine*.

Or there may be prepared a Conſerve of the leaves of the *Tree of Life*, with an eqnall part of *Sugar* : doſe \mathfrak{z} β . to \mathfrak{z} i. twice in a day.

Take of *millipeds* prepared \mathfrak{z} iii. of *ameos ſeeds* \mathfrak{z} i. make a powder, divide it into 10. parts, take a doſe twice in a day, or 12 *Sows* or *woodlice* bruſed, and *white-wine*, put to them, let the juce be wrung out, make a draught, let it be taken twice a day.

In the mean time, while theſe Medicines are taken Inwardly, it is ſometimes convenient to raiſe bliſters; with Veſicatories, in the nape of the neck and behinde the ears ; for ſo the ſerous and ſharp humours, are very much brought away from the head : beſides, ſneezing powders, and ſuch as purge Rhume from the head, often give ſignal help. The taking away of Blood from the Sedal veins, or the foot, ought ſometimes to be itterated ; yea, and the Diſtemper urging, *Plaſters* or *Cataplaſms*, are profitably applyed to the ſoles of the feet. It is alſo beneficial to apply drawing medicines, about the calves and thighs.

CHAPTER VI.

Of Convulſive Motions, whoſe cauſe ſubſiſts about the extremities of the Nerves; or within the nervous foldings.

Sometimes Convulſive diſtempers do ariſe, without any fault in the Head, by the irritation and exploſion of the ſpirits, remaining about the extremities of the nerves, which plainly appears; becauſe, when medicines haul ſharply the Ventracles or Inteſtines, or worms gnaw them, there do not only follow Convulſions

sions in those parts, but besides, convulsive motions do sometimes torment (or are retorted on) the members, and outward Limbs: for indeed, as we have shown elsewhere, when the sense of a very grievous Trouble torments any part, and from that is communicated to the chief Sensorie, presently from thence, an involuntary, and irregular motion, is wont to be reflected on the spirits in that place irritated; and that not only by the same nerves, to which the sense of the pain was carried, but sometimes also the Convulsion is reciprocated, by others, either neighbouring, or altogether extraneous: So the Stone being fixed in the Ureters, and irritating very much its nervous *fibres*, excites Convulsive motions, not only in the distemperd Vessel, but almost in all the *Viscera* of the Abdomen; So that, the urine being suppressed, Torments diffused here and there, and very often horrid Vomitings follow. Wherefore, 'tis not at all to be doubted, but that both diseases, and some Convulsive Symptoms, are very often induced, by reason of an outward hurt, brought to the Tops of the Nerves, terminating within the membranes, muscles, or *Viscera*: yea, in the hysterical, *hypochondriacal*, and certain other passions, if at any time Convulsive motions are excited, in the hurt head, by the fault of the womb, spleen, or other Inward; verily they arise by this only means, to wit, by the Trouble of the rest of the parts, being translated this way through the Nerves, (but in no wise, by the Vapours) to the brain, and are propagated, all about, into various Regions of the Body.

Convulsions begin from the ends of the Nerves, both by reason of irritation.

And by reason of an Explosive Copula.

But it should here be noted, that although the evident Solitary cause, forasmuch as it is strong and vehement, may sometimes induce Convulsions of it self, and without a prævious disposition: because indeed the Animal Spirits being irritated, beyond measure, begin greater and more than ordinary explosions, as in overgreat purging, and Vomiting, and the fits of the Collick, and Stone, is ordinarily wont to happen; yet in many other Convulsive Distempers, whose fits are often and habituall, besides the irritation made, about the extremities of the nerves, which serves for the most part for the evident cause, also a certain more remote cause is present, to whose efficacy the assault of the disease is chiefly beholden; to wit, when Convulsive motions are wont to be excited, and at every turn repeated, by the fault of the Spleen, womb, or other private part, it may be suspected, that the animal Spirits, of the *Fibres* in the distemperd part, and those disposed in its neighbouring parts, had first contracted an heterogeneous, explosive *Copula*, by which being filled, to a running over, they were provoked, by a light occasion, to Convulsive explosions: Then, those being first begun, about the extremities of the nerves, creep upwards by the passage of the same nerves, and are often caryed to the same nervous origine, and sometimes beyond, to the middle of the brain: from whence, lastly, being reflected, on the nervous stock, they also secondarily, cause the Convulsions of the members, and Limbs: But after the Brain, and a Superior portion of the nervous System, are wont to suffer, and be affected often, by the Convulsions below excited, the spirits inhabiting those parts, also begin to be themselves adulterated at length, and to admit an heterogeneous and explosive *Copula*, and so to acquire, in part, a procatartick cause; hence at length, a Convulsive procatarxis or more remote cause, becomes Common to either end of the Trunk of the same nerves, and the animal spirits of one nerve, or more, being evilly disposed, both at the head and tail, conceive explosions from either part, and deliver them presently to the other, as shall be more largely declared below, when we treat particularly of hysterical, and other passions. in the meantime, we will add some histories, and observations, of Convulsions, arising from the farther ends, or extremities of the Nerves.

Observation.

A fine maid, about the 16th. year of her age, falling from her horse, and lighting upon a Stone, grievously hurt her left breast, from whence a Tumor arose, with pain, which Symptoms notwithstanding by the use of medicines, at the beginning seem'd to be mitigated, and to be indifferently well, for a long time after. Three years after, she having taken cold, and having observed but a bad course of dyet, all things began to be exasperated, the hurt part swelling into a bigger bulk, troubled her with an accute, and almost continual pain, that the sick Virgin, for the cruel torment, could take no rest, for many days and nights, neither could she suffer the *glandula's* of her Breast, being then made more tumid, to be either touch'd or handled, yea nor any noyse, or shaking to be made in the Chamber.

When

When to this Tumour, about to degenerate into a Cancer, they had applyed fomentations, and Cataplasms of *hemlock*, and *mandraks*, and other stupifying and reperculsing things, this gentlewoman began to suffer certain Convulsive affecti-
ons, infesting her very often : At first, as often as the pain in her breast did most cruelly torment her, she felt in that place, prickings, also convulsions, and con-
tractions, running about here and there : then presently her *Ventricle*, and *hypo-
chondria*, and often the whole *Abdomen*, were wont to be inflated, and very much distended, with an endeavour of belching, and Vomiting ; by and by, the
same distemper, being leasurely translated to the superior parts, excited Insensibi-
lity ; to which shortly after, Convulsive motions succeeded,, in the whole Body,
so strongly, that the Sick party could scarce be held, by three or four strong
men.

These kinde of fits, at first were wandring, and only occasionally excited : to
wit, they would come, as often as the pain of her breast was strained, by some e-
vident cause : Afterwards, these Convulsions did more often infest her, and at
last, they became habitual, and periodical, twice in a day, to wit, they were
wont to come again constantly, at so many set hours after eating : And when
after this manner, the sick Gentlewoman, had been miserably afflicted, for six
months, at length, she began to be molested with a vertiginous Distemper of her
head, exercising her almost continually : for which evill, when a fomentation of
aromatick and cephalick herbs, had been a good while administred to her head,
she became better, as to the giddiness ; but then she was perpetually infested, with
a quite new, and admirable Symptom, *viz.* an empty cough, without spitting,
night and day, unless when she was overwhelmed with sleep : After this worthy
Virgin, had tryed without much benefit, diverse medicines and remedies, pre-
scribed by severall Physitians, she was at last helped, by making use of the most
temperate Bath, at the *Bath* ; then being presently married, after she had con-
ceived, and was brought to bed, she by degrees grew well.

If the reasons of the whole disease and its Accidents, be inquired into, without *The reason of*
doubt, the convulsive distemper, was first of all excited from the tumour, or pai-
ned place of the breast ; the cause of which was, partly the most sharp sense of
pain, being impressed from its *fibres* and nervous parts, but partly by the hetero-
geneous Copula, being affixed on the spirits inhabiting those *fibres* and nerves ; for
truly, it may be suspected, that the most sharp humour impacted in the Tumor,
which perhaps had in some sort flowed thither, by the passages of the Nerves,
being reperculsed, by the use of Topicks, had entred the *fibres* and nervous fila-
ments, or little strings disposed thorow the whole border or neighbourhood, and
so the heterogeneous, and explosive Copula, had clove to the spirits ; for the
shaking off of which, as often as by pain they were excited, they entred into con-
vulsive explosions, and together with them, other spirits flowing within the
neighbouring Nerves, by consent of the forms (as it often happens) were ex-
ploded after the same manner : Then the convulsive distemper, when it first had
begun in the extremities of the Nerves, being continued thorow their passages,
even to the head, was wont to cause the insensibleness, and from thence, leaping
back upon the whole *nervous system*, the convulsive motions, of the Limbs and all
the members : The fits, about the beginning of the sicknesse, being excited after
this manner, by reason of pain, from the distemper'd part, were carried secon-
darily to the brain, and its appendix : But afterwards, when the spirits inhabiting
those places, being often exploded, by sympathy, had so loosned, and weakned
the pores of the containing parts, that there lay open a passage, within the same,
for all heterogenious particles to enter, with the nervous juce, the convulsive
procatarxis or more remote cause, also increased in the head ; and the spirits in-
habiting the *Encephalon*, being infected with an heterogenious Copula, they them-
selves begun the convulsive fit, or at least afforded the first instinct to its assalt,
which did return, for the most part, at such set hours after eating, because the
morbific matter, was carried in, together with the nervous juce, almost in an
equal dimension : In truth, in such cases, where the convulsion being generall,
doth possess almost all the parts of the whole *nervous system* successively, we may
suspect, that the animal spirits, had contracted an heterogenious and explosive
Copula, in the whole nervous stock, which, when it is arisen, at the set time,
to a fullness ; incites the spirits themselves, at the appointed time, in like man-
ner

ner to explosions, and the same explosion, being begun somewhere, is propagated in order, to all, after the manner of a fiery enkindling.

As to that empty cough, which succeeding the fomentation of the head, exercised this sick person almost incessantly for many months ; it seems, that this Symptom should depend altogether from the *nervous origine* being distemper'd, and not at all on the stuffing of the Lungs, for she did not avoid any thing with the cough ; and if at any time that force of coughing was violently restrained, presently she was troubled with the sense of choaking in her Throat : So that, as it is very likely, the morbid matter laid up near the *nervous origine* being rarified and stirred, by the fomentation, entred more deeply the heads of the nerves, appointed for the Lungs, and stirred up in their *fibres*, and *filaments*, perpetuall convulsions : after the like manner, as when the nervous juce, which waters the *fibres*, and tendons of the Muscles, being made sharp, and degenerate, induces to those parts, continual leapings and contractions : hence, when a Convulsion or spasm was stop'd, in some branches of the distemper'd Nerves, so as she could not cough, presently the Convulsive motion, running into other branches, of the same neighbour Nerve, stirred up that choaking in the Throat. I will here propose another example of a Convulsion, arising from the extremities of the Nerves being affected.

2. Observation. A noble Matron, of fifty years of Age, after her courses had left her for about half a year, began to complain, first in a pricking pain of her left pap, then afterwards, that distemper leaving her, she was ill about her ventricle, for there arose an hard, and as it were a scirrrous Tumour, with a sad pain ; upon this came an inflation of the stomach, with difficulty of respiration, a nauseousness, and frequent Vomiting : Then the disease encreasing, with a more sharp pain running about here and there, she fell into Convulsive distempers of the ventricle : to wit, in that place, she was almost continually troubled, with Convulsions variously running about, just as if her ventricle had been torn to pieces : Besides a constant perturbation of minde, with thirst, and watchings, and a frequent *delirium* of spirits, as if she had been just dying, exercising this sick Lady : All which symptoms, she plainly perceiv'd to arise, from that Tumour in her ventricle : They saw that all vomitory, cathartical, antiscorbuticall, and hysterical Medicines, did her no good, but were rather hurtfull, and troublesome ; she received some benefit, by the taking away of blood by Leeches, and by the use of Asses milk, and afterwards she was much eased, by the long drinking of spaw-waters.

The reason of it.

The aforesaid Symptoms, which commonly are ascribed to the hysterical passion, and the vapours from the womb here plainly appear, to have proceeded from a Tumour, arising about the bottom of the ventricle : for that the blood of this Lady, being very hot, and melancholick, when it could be no more purged, by her courses, flowing from her, it laid up its recrements, and adust faculencies, at first in her breast, and then from a new beginning, in the membranes of her stomach : From the tumor there made, sharp and heterogenous particles falling down perpetually, entred the *fibres* and nerves, planted round about ; which cleaving continually to the spirits, dwelling in, and flowing into those parts, excited them to frequent explosions, and so made Convulsive distempers, in all the neighbouring parts : But that sometimes the convulsive motions were more light in that place, hence it appears, that the whole nervous stock, and the head it self (as is wont to be in greater convulsions) had not as yet been touched, with the same distemper : But the disorder of spirits, arising about the parts affected, and from thence transfer'd, by a smaller undulation or waving to the head, and so only lightly disturbing the spirits, inhabiting it, induced watchings, with a great heat, and perturbation of the phantasie, what we have hitherto discoursed of Convulsions, from the morbid cause settling upon either end of the nervous system, will more clearly appear, when we shall hereafter treat particularly of the chief kinds of convulsions, *viz.* the hysterical, hypochondriacall, and other passions : In the mean time, there will be no need to add a Curatory method, for this *Hypothesis* of convulsions, arising by reason of the extremities of the nerves being affected, because the ways of curing may be better accomodated, to the passions of this kinde, hereafter particularly to be spoken of : But for the present, it behoves us, to proceed to the unfolding of the convulsive passions, whose cause, or morbidick matter, seems to subsist, within the nervous foldings.

We

We have largely enough, in another place, discoursed of the nervous foldings, and in their description, and use, we have shown, that 'tis very likely, the more grievous fits of convulsive motions, beginning oftentimes within these parts, are from thence propagated on every side, into the neighbouring parts, and not seldom to a great distance: at least, that it seems much more probable, that the heterogenious and explosive particles, after they have overcome the tract of the head, and its medullary *appendix*, and being more deeply slid into the Channels of the Nerves, and their passages, together with the juice watering them, do spread their stores within the nervous foldings, as it were in Cross-streets, and by paths, and there sometimes make their stations, untill at length, being more plentifully heaped up, they as it were with Collected forces, produce the more cruel convulsive distempers: This I say, appears to be much more probable, than *That the nervous foldings is the seat of Convulsive matter.* (what is commonly said) to suppose them vapours, arising from the womb, spleen, ventricle, or any other inward, in which all the fault is easily thrown: For within these foldings, there are spaces large enough, for morbid mines, that the matter may be there at leisure laid up, and remain, till it be gathered to a fullness: But then, because we believe, that great plenty of spirits lodge there, more than in any other little cells, the heterogenious *Copula* growing to them, lays as it were tinder for more grievous explosions, so that, the spirits being exploded within these bodies, do not only inflate, and dilate them, but elevate and lift them up, from their Place (even as a house blown up with gun-powder;) wherefore the parts lying over them, are suddenly lifted up into a tumour, and loose are drawn violently hither and thither. That after this manner, the more cruell fits of Convulsions, about the *præcordia*, and *Viscera*, are very often stirred up, I have found to be true, besides the Arguments taken from reason, not long since by my own sight: For when I opened the dead body of a Gentlewoman who had been exceedingly troubled with (as they say) the Mother fits, or hysterical Distempers, I found the womb wholly faultless, but the Nerves near the foldings of the *Mesentery*, (as it seem'd) only to be lifted up, and elevated into a bulk, and the membranes of that inward, appeared torn, and loosened one from another, as being on every side tumid, and loose, as it were blown up into little bubbles, or bladders.

Indeed there are more considerations of solid reasons, whereby we are induced to believe, that the passions called hysterical, do most often arise, from the convulsive matter, heaped up within the *Mesenterick* enfoldings, and by turns exploded: which shall be more clearly manifested, where we treat especially of those diseases: But, neither is it less probable, that the Collick-pains, do very often proceed, from a more sharp and irritative matter, contained in the same enfoldings. Besides, as often as the convulsive fits seem to begin from the spleen, or ventricle, by reason the beginnings of which are inflations, and very great disturbances of those parts, it is likely, that the nest of the convulsive matter, was hid within the nervous enfoldings, belonging to the spleen or ventricle: Also, this kinde of matter, seems to excite within the Cardiac foldings, most heavy tremblings, and passions of the heart; and within the pneumonic, or cervical, (or those belonging to the Lungs and throat) enfoldings, most terrible fits of the Asthma. In our Treatise of the Nerves, we have related a notable case, of a worthy Gentlewoman, to whom a serous matter, wonted to distill from the forepart of her head, through her left nostrill, fell down behind her ear: where, when the most cruel pain did infest her; Convulsions also, and admirable contractions followed: whereby the joynting or compaction, now of the brain, and the whole head, seem'd to be pulled downward, now the throat, *præcordia*, and *Viscera* upwards: which kinde of Convulsions, vexing the parts so opposite, and at such distance, by turns, when they did proceed from one and the same seat, of the disease, planted in the midst, it will be obvious to conceive, that the grieved place, as the origine of either convulsive affection, was the ganglioform enfoldings, planted near the *Parotide*, or the two chief *Arteries* of the throat: into which, the Nerves both of the wandring pair descending from the head are entered, and out of which the shoots do stretch themselves, into the muscles of the throat and branches, into the *præcordia*, and *viscera*. Further, from the same cause, to wit, the convulsive matter, heaped up, and by turns exploded, within the ganglioform enfoldings, we think, (and not undeservedly) that sense of
choaking

choaking in the Throat, so often excited in the convulsive fits, did proceed. But there will be a more fit place, to speak of this, when we shall particularly handle the convulsive diseases, and symptoms. We shall now endeavour, to search into what remains, of the last kind of Convulsions, of which we made mention above, to wit, which relies on the nervous Liquor being infected, thorow its whole mass, with heterogenous and explosive particles, and for that reason, irritating the whole processes of the Nerves, and the nervous bodies, into universal Spasms, or Convulsions; and those either continual, or intermitting.

CHAPTER VII.

Of Convulsive Motions, arising from the Liquor watering the nervous Bodies, and irritating their whole processes into Convulsions.

Chiefly three
kinds of causes
of universal
Convulsions.

THat Convulsive distempers do sometimes wander thorow the whole nervous stock, and infest now these parts, now those, now many together, is so noted, and obvious almost to daily experience, that nothing can be more: we may therefore take notice, in these, that the tendons of the Muscles, do every where leap up, and are drawn together with spasms; in others, some exterior members, are bended, or stretch'd forth, with various flexions, and contortions, here and there, after divers manners, we have seen some, forced by the unbridled, and untamed force of the spirits, as if struck with madness, to run, or leap about, or strongly to smite, with their feet, or fists, the earth, or any objects: which if they should not do, forthwith they would fall into swooning fits, and horrid Eclipses of spirits. It would be too tedious, to enumerate all the cases of universal Convulsions, wandering thorow the whole nervous stock: But the symptoms of this kind, tho they are various, and manifold, may be reduced nevertheless to three chief Heads; to wit, forasmuch as they depend chiefly upon three kinds of causes; for indeed, in these wandering Convulsions, we ought to suppose, the whole nervous Liquor to be vitiated, and the animal spirits, flowing every where in the same, to be adulterated, and for that reason, to be almost perpetually exploded: Take notice then, that this kinde of Infection, is most commonly impressed on the nervous juice, and the spirits every where flowing in it, by one of these three ways, viz. 1st. By Poysons or witchcraft. 2dly, From malignant, or ill-cured feavours, in which the morbid matter is poured forth, on the Brain, or nervous stock. Or 3ly, when the nervous Liquor, by a long tract of time, by reason of the scorbutic, or otherwise vitious distemper, doth degenerate from its due constitution, into sour, or acid, or any otherwise præternatural, and Convulsive Liquor: we will here consider of each of the aforesaid cases, and first of all, of the fits of Convulsion, which are produced by poysons, or Sorceries.

From poysons
and sorceries.

From poysons
of the rank of
vegetables.

From a mad
Dog.

First therefore, it is somewhere shown by us, that some poysons, do act rather on the nervous Liquor, than on the blood, which depraving it, most strongly induce Convulsive distempers: And it appears clearly, from the eating of *Hemlock*, the *laughing-Parsly*, *man-drakes*, the furious *nightshade*, *wild Parsnips*, and other hurtfull herbs, how soon after, horrid Contractions of the *Ventricle*, *numbness*, *delirium*, Convulsions, twitches of the *tendons*, in the whole body, were wont to follow: Besides, those kinde of Convulsions follow upon the biting of a mad Dog, and other venomous beasts, where the Virulent infection, being received by the nervous juice, and lurking a long while in it, at last puts it self forth, and infects, and poysons, the whole mass of Liquor, in which it was involved, with its ferment. But what doth yet more illustrate it, are the admirable Symptoms, the truly painfull Convulsions, and unweariable dancing, which Authors have related to follow, upon the biting of the *Tarantula*: and indeed, might seem fabulous, unless that the truth of the Thing were asserted, by many men of good Credit, both ancient and modern: For besides *Mathiolus*, and *Epiphanius*, *Ferdinand*, *Gas-*
send.

Gassendus, and *Kircher*, add, that themselves were eye-witnesses, of this distemper: yea it is said, 'tis a known thing in *Apulia*, and found almost by dayly experience, that in that part of the Country, there are *Phalangii*, or a certain kinde of Spider, which is called *Tarantula*, from *Tarenta*, an ancient City of *Apulia*. This little Animal, being very frequent in the Summer, often bites the heedless Countryman, and infects him with its Venemous stroke, from whence presently succeed, a pain in the hurt part, with a Tumor, and itching, by and by, in various parts of the body, a numbness, and Trembling, also Convulsions, and loosnings of the members, and other Convulsive Symptoms, with a great loss of strength; as may be collected from *Mathiolus*, *Ferdinand*, and others, relating the wonderfull effects of this Disease. But truly, what these Authors say concerning the cure of this Distemper, and is practis'd commonly thorow the whole Country, is worthy of great admiration: for those stung with a *Tarantula*, as very sick as they are, as soon as they hear musical Instruments, presently they are eased of their pains, and leaping into the middle of the room, they begin to dance, and jump about, and so continue it, a long while, as if they were well, and ailed nothing: but if it happen, that the Fiddlers leave off never so little a while, they straitways fall to the ground, and return to their former pains, unless by the incessant musick they dance, and leap, till the poyson be wholly shaken off: For this end therefore, Musitioners are hired, and are changed by turns, that without intermission of the noise, those who are bitten, may dance so long, till they are quite cured. Thus saith *Mathiolus*: to which *Ferdinand* adds, that poor people do expend almost all their substance, in these fiddlers, and musitians, who wander up and down all that Province; and by playing to these *Tarantulasized* people, make much benefit: they dance or leap about, in the villages, and publiick streets, and fields, some one day, some one week, and others more. To these Authours, the most learned men *Gassendus*, and *Kircherus* agree, both of which, have related it from their own observation, that they have known such affected; and they assert, that they are not affected, or excited, indifferently with any musick, but with certain kinds of Tune, and that they dance to some measures, before others.

Let us inquire a little further, into the Reasons of these aforesaid Accidents, if we may follow our conjecture, in this first place, 'tis without doubt, that a certain venemous infection is fixed on the humane body, from the bite of this little creature, which tho it being less infestous to the blood, and vital spirit, as soon as ever it passes from it, into the nervous Liquor, it presently unfolds it self, thorow its whole mass; like leaven, and infects the animal spirits, flowing every where in it; so that indeed, they being drawn one from another, and here and there inordinately moved, induce convulsive distempers, which are accompanied now with the contractures, now with the languishing, and resolutions or loosning of the containing parts.

But why the painfull Convulsions, which are raised by the bite of the *Tarantula*, being presently allayed by musick, are wont to turn into dancing, does not so plainly appear. That some affirm, this little animal (for that by the testimony of *Aristotle* it should be most wise) to be delighted with musick, and for that reason, its venom being impress'd on man, by fermenting the humours, to induce the like love of musick: I say, this conjecture will not satisfie a minde desirous of Truth, because, that supposes a musick-loving nature in the spider, and the same to be communicated to man, by a *metastasis*, or as it were a certain *metempsychosis*, or transmigration of soul, both which are taken upon trust, and little satisfactory, but it may be rather said, that the venome inflicted on the nervous liquor, by the bite of the *Tarantula*, is too gentle, to be able to extinguish wholly the Animal spirits, or to dissipate them very much asunder, and to compell them into more cruell explosions, but only to put them to flight, and to incite those flying here and there, into lighter, and somewhat painfull Convulsions; and that the Musick, with its flattering sweetnesse, doth congregate together, and mutually associate, with ease, the spirits so dissipated: wherefore, whenas the same spirits, by reason of the Infection sticking to them, are apt to involuntary and Convulsive motions, the melody disposes them, delighted together, and directs them to such Convulsions, that entring the bodies of the nerves, by a certain Course, and Order, they are carried as it were in certain prescribed limits and compasses, until at length the particles of the venome, being quite evaporated,

and

The reason of the symptoms of those bitten by a Tarantula.

In what the reason of the Musicks allaying the symptoms consists.

and the fury and rage of the spirits being worn out, they wholly shake off that madnesse. For truly, musick doth easily carry men sound and sober, whether they will or no, or thinking of another thing, into actions answerable to the sound of the harmony; that presently the standers by, at the first striking up of the Fiddle, begin to move their hands and feet, and can scarce, nay are not able, to contain themselves from dancing: Let none therefore wonder that in men bitten by the *Tarantula*, when the animal spirits being moved, as it were with goads, they are compelled to leap forth, and wander about hither and thither willingly, if they are excited to dancing, and composed measures, at the stroke of an harp; so that as in these distempers, the spirit of the musick, as it were enchanting the outrageous spirits, and in some measure governing, and changing their convulsive motions, serves instead of an Antidote: for that the animal spirits, being very much, and for a long while exercised, after this manner, wholly shake off the Elastic *Copula*, contracted by the poyson, or otherwise; and they being very much wearied, at length rest from that madness, or its incitation.

A description of the dance of St. Vitus. That which is called the *Dance of Saint Vitus*, is an evill akin to this, concerning which *George Horstius* relates, that he had spoken with some women, who for some years, visiting the shrine of *St. Vitus*, which is in the borders of *Ulme*, did there exercise themselves, even night and day, with dancing and discomposure of minde, till they fell down like people intranc'd: by which means, they seemed to be restored to themselves, that they felt little or nothing for a whole year, till about the time of *May* following, when by the inquietude of their members, they say'd, they were so far tormented, that they were forced to go for their health sake, yearly, to the aforesaid place, about the feast of *St. Vitus*. *Horst. Epis. Med. sect. 7. de admirandis Convulsionibus.*

The reason of it.

Indeed it is a usuall thing (as I have observed) both for men, and women, to be sometimes tormented with this inquietude of their members, and as it were with a fury or madness, that they have been forc'd to walk, till they were tyred, as also to dance, leap, and run about, here and there, that by this means they might shun the grievous trouble, and sometimes faintings away, which were about to invade them: The reason of which seems to be, that the animal spirits, forasmuch as they being incited, by an heterogenous *Copula*, in the whole nervous kinde, become fierce, and altogether unbridled, which so to exercise, and tire out, there is need, both that they themselves may be tamed, and that the explosive *Copula*, may be shaken off.

Universall Convulsions from Witchcraft.

That Convulsive distempers are sometimes excited by witch-craft, is both commonly believed, and usually affirmed, by many Authors worthy of credit: and indeed, as we do grant, that very oftentimes, most admirable passions, are produced in the humane body, by the delusions of the Devill, forasmuch as he, to cause wonders, by which he might rule, by the subtletie of working, insinuates to the sensitive soul, or the constitution of the animal spirits, heterogeneous Atoms, or little Bodies, and so adds now spurs or pricking forward, and now casts chains on its functions, and now carries them to mischief: also by some means he enters himself into the humane body, and as it were another more mighty soul, is stretched thorow it, actuates all the parts, and members, inspires them with an unwonted force, and governs them at his pleasure, and incites to the perpetrating of most cruel, and supernatural wickednesses: yet all kinde of Convulsions, which besides the common manner of this disease, appear prodigious, ought not presently to be attributed to the enchantments of Witches, nor is the Devill presently or allways to be brought upon the stage. For indeed, as often as a childe, or relation, of some man of the richer sort, is by chance taken with most cruell, and unusuall Convulsions, for the most part, it falls out, that by and by the next old woman is accused of witchcraft, she is made guilty, and very hardly, or not at all, the wretch escapes the flames, or an halter; when in the mean time, the disease, proceeding from causes meerly natural, may be easily Cured, by no other Exorcism, than Remedies usually prescribed against convulsive diseases: In truth, the animal spirits being indued, with a more cruell explosive *Copula*, and being stricken by it all of a heap together, obtain so much strength, and vigour, beyond their proper and wonted power, as the flame of gunpowder, has above the burning of the common flame; so that those, who obnoxious to this disease, out of the fit, may be govern'd, lifted up, and moved at pleasure, with the light help

Which are commonly but falsely so thought.

The reason of them.

help of one man ; when the same is upon them, make nothing of the utmost endeavours, and force, of at least four of the strongest men : But if in the case of any one that is sick, there arise a suspicion of witchcraft, or fascination, there are chiefly two kinds of Motions, that are wont to create, and cherish this opinion, *viz.* 1. If the patient doth perform the contortions, or gesticulations of his members, or of his whole body, after that manner, which no sound man, nor mimick, or any tumbler can imitate. Then 2dly, If such strength be shown, that surpasses all humane force ; to which, if the avoiding of monstrous things happen, as when bundles, as *Henry van Heers* relates, are cast forth by vomit, or a live Eel, as *Cornelius Gamma* tells, voided by stool, without doubt, it may be believed that the devill has, and doth perform, his parts in this Tragedy.

*Which argues
witchcraft.*

It were easie to heap together, very many, and indeed admirable histories, of persons of every Age and Sex, affected after a stupendious and as it were supernatural manner, with the manifest suspicion of witchcraft : for such are every where extant, among Authors, both Physitians, and Philosophers ; and because vulgar rumour, noyses about diseases, caused by witchcraft, to happen often in almost every Country : but because these kinde of cases, are full of Imposture, or allways increased, by the fictitious lies of the relators, to create admiration, (and for that they rarely fall under the medicall cure) I will here purposely omit them : what remains is, that I proceed to unfold, the next kinde of universal Convulsions, to wit, which comes upon malignant, or otherwise irregular, or ill-cured Feavours.

CHAPTER VIII.

Of Universal Convulsions, which are wont to be excited, in Malignant, ill-cured, and some irregular Feavours.

THat Convulsions sometimes happen to persons sick of Feavours, almost every ordinary body understands, and from thence takes a remarkable Prognostication, of Death, or perill : For in malignant Feavours, also sometimes in the ordinary ill-handled, as the *Virtego*, or *Delirium* arise, from the morbid matter being layd up in the Brain, from the Blood ; so from the same, being slidden down into the nervous stock, Contractures and twitches of the muscles, and tendons ; also sudden shakings of the members, and Limbs ; and sometimes most horrid stiffnesses, in the whole Body succeed : The reason of which kinde of Symptoms seems to consist in this, that the Liquor watering the nervous parts, abounds every where with heterogeneous particles irritating the Spirits : for by that means, the Spirits inhabiting, and influencing, being disturbed in their just Influence, and emanation, are incited into continual explosions, as it were a crackling noyse, not much unlike, as when the flame of a Lamp, being imbued with drossy and salted oyl, ascends with a noyse and sparkling : which kinde of Convulsive distempers, for the most part, happen about the height of feavours, when the morbid matter, being first layd up in the blood, is from thence transfer'd to the Brain, and that being pass'd thorow ; and also infected, it is caried into the System of the nerves, and from thence stirs up Convulsive passions, with, or without a *Delirium*.

*Universal
Convulsions
happning in
Feavours.*

*The reason of
the Symptoms.*

But indeed, it is sometimes observ'd, that, besides these kinde of Convulsive distempers, coming upon Feavours, and secondarily excited ; in a malignant constitution of the air, also from the breath of a Pestilent Contagion, the nervous Liquor hath been infected before the blood, or else apart from it, and therefore a *Delirium*, or Convulsions, have gone before a feavourish Distemper. Further, I have often observed, that some irregular Feavours have arose, in which the blood has been hardly seen to boyl up, or grow hot above measure, but the beginnings of this slow and very dangerous feavour, were layd chiefly in the nervous humour ; which being by degrees brought to maturity, did induce Convulsive Distempers, with a *Delirium*, or madness, and other wastings or exorbitances of the Animal Spirits. For the sick never complained of heat, or thirst, being

soon made feeble, and as it were strengthless, they were presently obnoxious to frequent giddiness, also to remblings of the Limbs, and as it were leaping forth, besides, to twitches or jumpings of the muscles, and tendons, and to contractions, and pains wandring about, here and there. This kinde of sickness, by some Physitians, because it seem'd to consist in the solid parts, rather than in the blood, is called a *malignant hectic feavour*; when indeed, the same being fixed chiefly in the nervous humour, may be better called, the *Convulsive nervous Pestilence*.

A description of a convulsive disease of Hassia, sometimes epidemical. There is mention made, by *Gregory Horstius*, of a *Convulsive*, and *malignant Disease*, which was sometime past *Epidemical*, in *Hassia*, *Westphalia*, and the neighbouring Countys: they being taken therewith, without a feavourish heat, immoderate effervescency of blood, whilst they were imployed about their familiar occasions, hardly perceiving themselves to be sick, were wont to have about their hands, or feet, and sometimes in both, a sense of tingling, with a numbness, running up and down: then by and by, their fingers, together with their Arms, and thighs, were now strictly drawn together, now most strongly stretched forth, as if they were frozen. Those kinde of Contractions, and extentions, rendred themselves by turns, and then changed places, that now the distemper resided in one part, then presently in another: But (as it often hapned) if the Disease, at once invaded the whole Brain, Universal Convulsions, and oftentimes epileptical Fits, infested the sick: besides, those labouring with it, were obnoxious at some turns, to a *Delirium*, *madness*, and sometimes a *Lethargie*: This sickness, continued a long time, without any *Crisis*, or sound solution, and could scarcely be so perfectly Cured, but that the Disposition of the Brain, and nervous parts, remained evill all their Life after.

The reason of the symptoms. As to the Reasons of this Disease, and Symptoms, it is obvious enough, that the same depends altogether upon the vice, and notable depravation, of the nervous juce. That pricking, or tingling, for the most part, at the first coming of the disease, was procured for this Reason, because that Liquor, beginning to be poysoned, and loosned in its mixtion, by the malignant Infection, presently it oppressed the animal Spirits, abounding therein; and inhibited them from their wonted, and free expansion; wherefore, they being half overwhelmed, and constrained to creep, as it were among briers, or things that catch'd hold of them, or held them back, they excited the sense, as it were of tinglings running about: but then, because this disease growing worse, the nervous Liquor was yet more perverted in its *Crisis*, or disposition; the heterogeneous particles, which were brought together in it, cleaving to the Spirits, caused them to be moved hither and thither, and to be unduly exploded; for which Reason, the Contractions and horrid distentions in the members, and the tumults, and great inordinations in the head, were raised up. But that in this feavour of the nerves a solution or difficult *Crisis*, or none at all hapned, the reason was, because the nervous juce being slow, and as it were mucilaginous, and therefore heavy in its motion, was not defæcated, or cleared, as the blood, by a critical effervescency, nor easily conceived, that kinde of fermentation, by which the pure, might be separated from the impure.

Indeed I have known a sickness, much like to this example, to be often excited in our Country, and to invade whole families, especially children, and the younger people. Some years since, a popular or childish feavour, very much infesting the Brain, and nervous stock, exceedingly spread in this country, yea almost thorow all *England*: The History of which Disease, being described in that time, in which it raged, *viz.* in the year 1661. I think it worth our pains to insert, in this place of our *Convulsive Pathology*: For from hence, it may appear, by what means, and from what causes, the Convulsive Symptoms, which come upon any feavours, are wont to be excited.

A Description of an Epidemical Feavour chiefly infestous to the Brain and nervous stock spreading in the year, 1661.

IN this Country, before the last Summer, viz. 1661. we had been free for above two years, from any popular disease, unless such only as usually come in some places; but then, before the Summer Solstice, the *small-Pox* (a distemper here rarely Epidemical) being rife in many places, raged very much: After that Summer, which was extreamly hot and dry, an Autumn moister then usual followed: and after which, a most mild winter almost without any cold: in all which space, the Earth was hardly covered with snow, or was ever hard frozen, above three or four days; so that within a few weeks, after the winter Solstice, the Trees began to bud, and the vernal plants to break forth; from the bosom of the Earth, and to flower, and also the birds to build nests: to this mild season, not even-tilated at the beginning of the spring, by the nitrous little bodys, that were wont to be blown from the North, a filthyness of showrs, and almost continual wet succeeded. After the vernal *equinox*, a certain irregular, and unaccustomed Feavour, seised upon some, here and there, which within a month, became so Epidemical, that in many places, it began to be called the *New Disease*; Raging chiefly among children, and youths; it was wont to afflict them, with a long, and as it were a Chronical Sickness: yea sometimes, old men, and men of middle Age, though rarely, were seised by it, and those indeed, it did sooner, and more certainly kill. The Distemper at first invading any one, did creep on them so silently, that the beginnings of the sickness, were scarce perceived: for arising without immoderate heat, or more sharp thirst, it induced in the whole body a great debility, with a languishing of the Spirits, and a torpitude or numbness of the function; The Stomack was ready to loath any victuals, and to be grieved at any thing put into it, and yet not easie to vomit. The sick were unfit for any motion, and only lov'd to be idle, or to ly down upon the Bed: within a short time, also sometime at the first coming of the Disease, they complained of a heavy *vertigo*, a tingling of the ears, and often of a great tumult and perturbation of the brain. Which kinde of Symptoms, were very often esteemed, as it were the peculiar signe, of the approach of this Disease, if in some, those had been wanting, or hapned to be more remis, instead of the head being affected after that manner, the disease took more deep root in the Brest, with an excited cough, as shall be told by and by. But whilst the brain, and the nervous *Appendix*, being after this manner affected, the animal Spirits, presently from the beginning of the sickness, were benumbed, a flow and as it were hec tick feavour, was inkindled throughout: but yet, the effervescency of the blood, which was hardly continual, but flitting, and uncertain, was according to the disposition of the blood it self, in some more intense, in others more remis; and therefore, thirst, the white scurf of the Tongue, and other Symptoms, which accompany a feavourish distemper, did more or less infest them: sweating did not willingly follow, nor could it easily, or by a light thing, be caused by Art: yea, neither this, nor any other evacuation, as it were critical, at any time succeeding, did suddenly help this disease; but it persisting for many weeks, and sometimes months, reduced the sick to the highest *Atrophie*, or wasting of all parts, and often infected them, with an incurable Consumption.

About the increase of the disease, which hapned in most, within eight days, if the Distemper (as it was often wont) did settle chiefly in the head, and nervous System, most grievous Symtoms, in their Dominions, viz. a plain Phrensie or deep stupidity or Insensibility did molest them. For I often observed, in many children, and not seldom in women, after seven or eight days from their falling sick, that their knowledge and Speech failed them, and so the sick have lain, for a long while, yea, sometimes for the space of a whole month, without any taking notice of the by-standers, and with an involuntary flux of their excrements; but if they continued in some sort the use of Judgment, and Reason, they laboured with a frequent *delirium*, and constantly with absurd, and incongruous *Chymera's*, in their sleep. But in Men, and others of a hotter temperament, from the mor-

The history of an Epidemical feavour raging in the year 1661.

Its procacat- tick or more remote cause.

The symptoms.

bific matter, instead of a *Crisis* being translated to the brain, a Fury, or dangerous; and oftentimes deadly phrensie did succeed. But if neither Stupidity, nor great Distraction did fall upon them, swimings in the head, Convulsive motions; with Convulsions of the members, leapings up of the *tendons*; did grievously infest them. In almost all the sick, the belly was for the most part loose, casting forth plentifully now yellow, now thin, and serous excrement, with a great stink: it was rarely that vomiting fell upon any one: The urine in the whole process of the Disease, (unless when the moribific matter, being caried more plentifully into the Brain, did threaten a phrensie) was highly red, so that some, by reason of the deep colour of the water, judg'd this feavour to have been plainly Scorbutick: which notwithstanding appeared to be otherwise, because *antiscorbutic* Remedies, (of which indeed many, and almost of every kinde were tryed) were little or nothing beneficial. It was most of all to be admired, how soon after the beginning of this Disease, the flesh of the sick consumed, and they reduced to the leanness of a *Skeleton*, when in the mean time, there was no great heat, that might by degrees consume the solid parts, nor any violent evacuation; which might greatly take them down.

Besides these evils molesting the region of the head, a distemper no less dangerous, oftentimes fell upon the breast. For in some, tho not in all, a cough very troublesome, with abundance of spittle, and thick, was excited: this hapned in some, about the declination of the disease, to wit, whilst the confines of the brain were serene, as it were the clouds sent from thence to the thorax, a great *Catarrh* suddenly rained down upon the Lungs. But in others, who especially had little infection of the disease in the head, presently after the beginning of the feavour, a cruell cough, and a stinking spitting, with a consumptive disposition, grew upon them, and suddenly, and unthought of, precipitated the sick into a *Pthisis*: from which nevertheless, they recovered, by the timely use of Remedies, often beyond hope. It was observ'd in some, that after a long ecclips of the sensitive facultie, and oppression of the brain, from the moribific matter, at length tumors did follow, in the glandula's, neer the hinder part of the neck, out of which, being hardly ripened and broke, a thin and stinking ichor or matter, ran for a long time, and brought help. I have also seen watery pustles, excited in other parts of the body, which pass'd into hollow ulcers, and hardly curable: sometimes little spots, and *petechiales*, appeared here and there: yet I never heard, that any more broad, or blew, of these kinde, were seen in the sick. Notwithstanding, tho this feavour was not remarkable for very many malignant spots, yet it was not free from Contagion. For that in the same Family, it invaded almost all the Children, and youths successively, yea not rarely those of more ripe years, and at mens estate, who looking to the sick, were familiarly conversant in their Chambers, or about their beds, were infected with the same infection: But indeed, there was not so much cause of suspicion, that for it, the friends of the sick should be wholly interdicted, from commerce with, or visiting of them.

Altho the course of this disease, (unless when it intimately settled in the brain) did appear so gentle, and continued without any horrid Symptome; yet its cure being always difficult, succeeded not under a long time: For the sick rarely grew well, within three or four weeks, yea for the most part, scarce in so many months. If this disease fell upon men of a broken Age, or strength, especially those who were before obnoxious to *cephalic* distempers, as the *Lethargie*, *Apoplexie*, or Convulsion, it oftentimes kill'd them in a short space: but if there was any hope of recovering, it could be but slowly procured, (all Remedies whatsoever scarce bringing any sensible help) so that the sick, did no sooner come out of the spear of this disease, than they fell into the confines of a Consumption.

The reason of
them.

If the formal reason, and courses of this aforesaid sickness be demanded, it here easily appears, the watering Liquor of the brain, and nervous stock, for the most part both together, with the blood, to be in fault, and the immediate cause, especially of the troublesome Symptoms: to wit, forasmuch as this water, presently after the first assault of the disease, was grown more poor then usuall, and as it were lifeless; therefore a Languishing, and enervation, with a *spontaneous* weariness, and impotency to motion, hapned in the whole body, and with a sudden wasting of the body, in the sick. Further, forasmuch as the same Liquor, was stuffed with heterogeneous particles; *viz.* partly narcotick, partly explosive, therefore

therefore, a numbness, a sense of pricking, leapings up of the tendons and muscles, and contractures, also the *Virtego*, giddiness, and other more grievous Cephalick distempers did arise : Moreover, forasmuch as by reason of the evil of the nervous juice, being not quickly or hardly to be mended, the cure or healing of the disease, became so hard, and lingring. But for that the fault of this *Latex*, necessarily depended on the discriasie or evill disposition of the blood, also of the depraved constitution of the brain, what their morbid dispositions were, and by what means they brought forth the beginning, or tinder of the Symptom of the feavour but now described, let us now see.

As to the former, it seems, that at this season, by reason of the hot and humi'd constitution of the year, and no blast from the north (the little bodies of which imbue the blood, and juices of our body, as it were with a nitrous seasoning, and by agitating them, defend them against putrefaction) the blood in most men, and chiefly in children, youths, and women, became like standing-water, that so contracts a settling, very impure, stuff't with heterogeneous particles, and turning to a clamminess, and watrishness ; in which, the more pure spirit and sulphur, being somewhat depress'd, the watery particles, being carried forth with the impure salt and sulphur, were too much exalted. Wherefore the blood, both by reason of its *Crisis* or constitution, being vitiated, also by reason of heterogeneous particles, being heaped up more plentifully in its bosome, was made more fit, either of its own accord, or occasionally, or because of the contagion, to receive a feavourish Effervescency, so that from thence, very many fell at this time into feavours. But the blood growing hot, from the feavourish taint being received, did not presently burn with an open flame, but like green wood laid on the fire, with a flame as it were suppressed, and much incumbred with smoke. Wherefore, the morbid matter, being heaped within its mass, was not wont, (as in a regular feavour) to be consumed by the burning, and its reliques, at the set time, to be exterminated by the *Crisis* : but yet, a little after the beginning of the feavour, a great portion of this matter being powred into the head, or *Thorax*, or into both at once, and afterwards being continually supplied in those parts, it induced either the aforesaid distempers of the brain, and nervous stock, or a cough, with a consumptive disposition, or both together, and for this reason, about the beginning of this disease, when a pulse quicker than it ought to be, and a high colour'd urine, and full of contents, did show the blood to grow hot with a feavourish distemper, the sick did not complain of heat, or thirst ; because the blood growing hot, did lay up its impurities, and recrements, forthwith into the provision of the nervous Liquor, or into the Lungs ; wherefore, within these receptacles, the Symptoms presently became worse ; but afterwards the disease growing on, a somewhat sharp heat, with scurfiness of the tongue, was wont to be troublesome to some : yea, in all, a slow, and as it were hec tick feavour, continued throughout ; which neither by sweat, nor by insensible transpiration, could be so wholly removed, but that it was daily renewed, chiefly after eating, tho never so small : which thing truly seem'd to happen, because the nervous juice being full of the feculencies, brought from the blood, did not afterwards receive them in so great plenty, but that these recrements, together with the nutritious humour, (and for that this was not consumed by nourishing the solid particles) remaining within the bloody mass, caused it then to grow feavourishly hot.

2ly, Besides this morbid disposition of the blood, contracted from the intemperance of the year, it seems, that the brain also, from the same occasion, was made prone to the aforesaid passions. For when, for a long tract of time, the southern winds did continually blow, with a moist constitution of the Air ; from thence, the passages, and pores of the brain, being very much loosned, and opened, and its connexion too much dissolved, they gave an easie passage, to serous humours, and for all sorts of heterogeneous particles : wherefore the blood being very feculent, and watery, as soon as it began to grow hot from the feavour, carried its serous recrements and filths, presently thorow the too open doors into the head : for whosoever he was, who did not complain of his head, being too much stuffed with a moist air, and numbness of spirits ; on the contrary, his pores being bound together, by an intense cold, or dryer air, all his senses, and faculties, remained more quick and lively.

These

These things being thus premised, concerning the morbid provision of the brain, and humours, to wit, of the blood, and nervous humour, by reason of the constitution of the year, whereby indeed, very many at that time, fell into a slow, unequal, and long continuing feavour, surrounded with *Cephalick* and *Convulsive* symptoms, and hardly curable: hence also it will be easie, to unfold the reasons, of the rest of the symptoms and accidents, chiefly to be noted in this disease.

Why this disease chiefly invaded children, women, and phlegmatick men.

For first of all, that this irregular Feavour, raged chiefly among Children, young men, women, and phlegmatick men, the reason was, because in those kinde of bodies, the blood was apt to be more waterish, and less perspicable, and from thence to gather a serous *Colluvies*, or watry humour, and heterogeneous feculencies; and also, the brain being more humid and weak, easily received any recrements of the blood. Wherefore it may be observed, that those sort of persons, were found more prone to Convulsions, arising by reason of any other occasions.

The reason of the Atrophie coming upon this feavour.

Secondly, the noted *Atrophie* or leanness, came so suddenly upon this feavour, because, by reason of the depravation of the nervous juice, the offices of nourishment, depending upon it (which, as we have elsewhere shown, are highly active) presently failed. For although we do not grant, the nervous humour to be only nutritious, but to dispense thorow the Arteries, a matter destined to the nourishable parts, prepared in the bloody mass; yet it may be lawfull to think, that the Liquor watering the brain and nervous stock, by means of an efficient cause, doth conduce very much to alimentation; for this growing turgid with animal spirit, actuates and invigorates the nutritious juice, brought to every part by the blood, and admitting it into the passages, and most intimate receptacles of the body to be nourished, and as it were leading it in, assimilates or resembles it. Wherefore, when this household Liquor is so depraved, that it doth not rightly supply the animal spirits, requisite about the work of nutrition, all the members and parts of the stomach vitiated in its tone, either spues back whatsoever nourishment is brought, or cannot receive it to its proper use: wherefore truly in this disease, the bulk or habit of the body, however fuller or fatter, was more sooner pull'd down, then in a continuall Feavour, where it might much more evaporate, by the intense heat, or copious sweats. The reason of which is, because in a burning feavour, altho the blood growing very hot, exhales more plentifully; yet in the mean time, it continually affords something of nourishment, which the severall parts, help'd by the benefit of the nervous juice, easily received, and assimilated; but in this nervous pestilence, altho the nutritive matter was sufficiently provided, yet by the defect of the Nourishment of the spirits, the nourishment was altogether inhibited.

Why this feavour was hardly curable.

3. For the aforesaid reasons also, this feavour, being a long while protracted, was wont scarce ever to be critically helped, and difficultly cured, by the help of almost any medicines: For the feavourish matter, creeping presently, from the beginning of the disease, into the nervous Liquor, could hardly afterwards, and not but of a long time, be exterminated from its bosome: for that this water, with a slow motion, and flowing leasurely in the streight vessels, does not as the blood, conceive of its own accord a purifying effervescency, or fermentation; neither can the forces of medicines, reach to it so easily, and unmixed: but either they are first hindered by other parts, or because they are heterogeneous, they are wholly excluded from the brain, casting back whatever is incongruous. In truth for this reason, all distempers of the brain and nerves, as it were making a mock at Medicines, are most difficultly cured. Therefore in this feavour, if the evill impressed on the brain and nervous stock was taken away, either a cruell cough with plentiful spitting, or tumours, or an Impostum in the neck did follow: to wit, the morbid matter being supped back, by the blood, and again deposited, settled either in the *Thorax*, or in the Glandula's, and emunctories, nigh the hinder part of the neck. But this disease, was the more contumacious, because the discriasie or evill constitution of the blood, was not easily mended: for altho from the beginning, its *Latex*, the recrements being poured forth, even into the nervous Liquor, grew but little and sluggishly hot; yet afterwards, these receptacles being filled, and the morbid feculencies, and besides the nutritious matter, not employed in nourishing the parts, being resident even in the blood, did aggravate it, and for the exclusion of this trouble, not to be mixed with it, did

did induce an Effervescency, such as is wont to be in an hectick feavour, either almost continuall, or presently apt to come again. For I have often observed in this feavour, from grewell, barley-broth, and other slender diet; no less ebullition of the blood to be stirred up, than from broth made of flesh: whether indeed the nourishing juice, supplying the blood from the chyle, because it was not employed in the work of nutrition, carried something heterogeneous, and not rightly miscible, as a trouble to the blood; and by reason of the particles of this superfluous juice, being copiously sent away with the *serum*, the urine became very thick, red, and very full of contents: Also, for the same reason, the belly was for the most part loose, forasmuch as the blood, filled full of the nutritious juice, did suck forth a lesser portion of the chyle from the bowells, and did pour back again part of that which had been brought to it, on the intestines; the feavourish distemper did likewise stick so long in the blood, because, till the animal regiment being restored, nutrition was rightly performed, that superfluous matter was carried into the mass of blood.

We deliver the example, and the *Ætiology* or rational account of this aforesaid feavour, more largely for this reason, because the same disease, did fall upon our Countrey men, here and there also at other times: for that of late, in this City, all the younger people of a certain family, were sick of it: yea, I remember, that some time past, very many laboured with such a feavour; Out of the many histories and examples of sick people, which it rendred when it was epidemical, I will here propose one or two.

A strong and lively young man, about the beginning of the spring, 1661, falling sick, without any evident cause, without any great heat or thirst, he became suddenly weak, and as if enervated, with a dejected appetite, and languor of spirits. *Cathartick Remedies, Antipyretics* or allaying of heat, digestives, and also antiscorbuticks, and others of various kinds, administered by the prescriptions of the most famous Physicians, availed nothing: But notwithstanding the sick man, hitherto languishing with a slow and wandring feavour, with a quick and feeble pulse, a deep-colour'd urine, had kept his bed a fortnight; besides, being reduced to the greatest leanness, he complained of a giddiness, and as it were the fluctuation of a sound in his head, and a tingling noise in his ears. Altho he was troubled with a great stupor, yet his sleeps were mightily troubled, and broken with delirious fables. After four days, when the feavour was not yet declined, it was thought good to take away four or five ounces of blood, by Leeches, from the fedal veins; from hence the feavour began to be much exasperated, for a great intense heat, with thirst, watchings, and almost continual tossing of the body; also the tongue dry, and scurfy, appeared; then quickly a troublesome cough, with abundance of discoloured spittle followed, to him were administered, *almond*, and *barly-drinks*, with temperate bechicks (or things to stop coughing) boyled in them; water of milk distill'd with *snails*, and pectoral herbs, the shelly-powders, prepared nitre, and often Cordial opiats; which notwithstanding scarce giving any help, the sick man still became more weak: when in this manner being sick above two months space, the feavourish distemperature, and cough also, daily growing worse, he seemed near death, at length a voluntary sweating arising, so that every night, or every other night, he sweat abundantly, and from thence finding himself better, using then the aforesaid Remedies, he grew well within six weeks.

Till I had seen many sick people after the same manner, I suspected this disease to be altogether an hectick feavour, with a consumptive disposition of the Lungs; but when I saw many others at that time fall sick ordinarily, after the like manner, I easily instituted the *Ætiologie* or rational account of this feavour, such as I have already described: to wit, that the blood, because of the intemperature of the year, and perhaps from errors in dyet, had contracted a vitious *procatarxis* or remote cause: Then it growing feavourishly hot, and presently carrying its impurities to the brain, and so depraving the juice, watering it, and the nervous stock, induced the vertiginous distempers, with a *stupor*, a languishing of spirits, and an *atrophy* of the whole body: but so long as the blood did transfer its recrements, from its own bosom, into the brain and nervous *appendix*, the feavourish heat continued more gentle and milde: But afterwards, when the tending downwards of the morbid matter, by the opening of the hemorrhoid veins, was drawn away

1. Observation,

The reason of it.

away from the brain; the same being first retained within the bloody mass, increased the feavour; then being poured on the Lungs, excited the cruel cough, with plentiful spittle: but forasmuch as the flesh of the Lungs remained free from putrefaction, as soon as the serous water was sent away by a more plentiful sweating, the sick man became free, both from the feavour, and *phthisis* or Consumption, that seemed so deplorable.

2. *Observation.*

In the mean time, whilst he lay sick, I visited another, about 12. years of age, after the like manner affected. But this when I was first sent for, having been sick above a month, was reduced to the leanness of a Skelliton: besides, he was troubled with a *vertigo*, with a noise in his ears, and deafness, and also with a violent cough, with yellow, and as it were consumptive spittle: his pulse was quick and feeble, his urine red and thick, his appetite much dejected, his spirits so languid, and his strength so cast down, that he could not keep out of his bed: I gave this youth to drink often in a day, water distill'd from milk, with snails and temperate herbs: besides I ordered him an open decoction, such as is in use for the Rickets, to be daily taken instead of his ordinary drink: by the help of which Remedies, he was restored to his health, in a months space. At this time I was sent for to many other people, of every age and sex, distemper'd by the same disease, now clearly Epidemical; for it, running thorow whole families not only in this City, and the neighbouring parts, but in the Countries at a great distance, as I heard from Physicians dwelling in other places, increased very much. Those for the most part labouring with this feavour, so be they were otherwise whole, grew well, by the fit use, and order, of medicine and dyet: but it hapned very often but ill to those, who were indued with a weakly constitution of brain, and nervous stock, or broken with age; but not seldom the case of the sick became dangerous because the Physicians were not wont to be sent for presently after the beginning of the disease, yea, scarcely before it had more deeply spread abroad its roots, and the opportunity of healing was past.

3. *Observation.*

For that reason, this feavour became very deadly, in the family of a certain Noble man, among his children, originally obnoxious to Cephalic distempers. About the vernal Æquinox, a Boy of about eleven years of Age, began to be sick: At first without any vehement heat, or thirst, a dejection of appetite, and want of strength came upon him: Besides, an almost continual giddiness did trouble him, with a frequent danger of fainting, that he often thought he was just dying. By the advice of a certain woman attending him, they dayly gave him Clysters: then, when from the foulness of the mouth, and Tongue, manifest signes of a Feavour appeared, this Emperick on the fifth day, gave him a vomit of the Infusion of *Crocus metallorum*, and on the seaventh day a Cordial powder being administered, she incited the sick youth covered with blankets to sweat: his skin hardly began to be moist: but presently he began to talk idly, complained that his Cap was fallen into the water, by and by becoming speechless, within four hours, whilst I was sent for, he expir'd before I came.

4. *Observation.*

A little while after, the same disease fell upon his yonger Sister: whose sickness however, because it was accompanied with a frequent and humid Cough, was thought at first to be only a taking of Cold; but within a few days, this Cough became plainly Convulsive: so that, whilst she Cough'd, the *Diaphragma* being caried upward, and with a renewed *Sistole*, held so a long time, she made a great noise as if about to be suffocated: then this little maid growing more apparently feavourish, complained of thirst and heat, and lay all night without sleep, with a mighty agitation of her body, and began to talk idly, after the same manner as her brother, of her coat being fallen into the water; and when all things grew worse, she began to be tormented with Convulsive motions, first in her Limbs, by and by in her face, and then in her whole body: the *Paroxysms* coming by often turns, twice or thrice in an hour, did most grievously trouble her, so that this little wretch, within the space of 24. hours, after the Convulsive Distempers began to grow more grievous, her animal spirits being almost quite spent, she dyed; whilst the Convulsive Fits tormented her, her pulse was very much disorder'd, and often intermitting, also a frequent vomiting molested her. Being sent for to visit this maid, also too late, a little before her death; when I could contribute nothing to the proroguing of Life, I endeavourd what I could, to finde out from her Death, the knowledge of the aforesaid disease, therefore having

got leave to dissect her body, the reasons, and marks of the Symptoms chiefly urging, in this feavour, more clearly appear'd.

Opening therefore first the lower belly, I found all the bowells in it sound enough, and well furnish't: The *ventricle*, altho tyred with empty vomiting, contained nothing besides the Liquor, lately taken in at the mouth: for neither in it, nor in its *Appendix*, were worms, or sharp humours found, which are wont oftentimes to give a cause to these kinde of Convulsions: the small guts, were in many places mutually involved: to wit, the *Convex superficies* of one part, was thrust into the concave of another, as into a sheath, and hid far in it, which indeed I judge to have hapned, wholly from the convulsive Motions of those bowels: for whilst by reason of the vehement Convulsion, excited from the nervous *origine*, the opposite *fibres* being drawn together, did work the same Intestine, into contrary motions, it easily hapned that a part of the Intestine of the *Ilium* being carried upward, might run into the hollownes of the other, being snatch'd downward.

*The kn wleldg
of the disease
found out by
dissecting the
Carcase.*

The *Thorax* being opened, the flesh of the Lungs appeared very red, and as it were sprinkled with bood, yea in some places as it were livid, and almost black: out of the same whereever it was cut, there flow'd forth a thin and frothy matter. Certainly this shew'd, that the feavourish matter, or the ferous impurities of the boyling blood, being soon impacted in the Lungs, did so stuff up their pores and passages, that the blood it self, being in its wonted and free Circulation, there stagnating, and being extravasated, did excite a certain Inflammation.

We found a no less clear track, of this so deadly disease in the head: for the shell of the skull being removed, presently the vessells, creeping thorow the *meningæ*, were seen to swell very much with blood, as if almost the whole mass of blood, were gathered together in the head: for the veins being cut or broken, about the Inwards of the lower and middle belly, little blood flowed forth: Besides, those membranes where they cloath the *Cerebel*, and being higher spread divide it from the brain, being sprinkled in very many places with extravasated blood, were noted to be of a black-purple colour; that it was not to be doubted, but the *Phlegosis* or Inflammation round about excited, was the cause of the so cruelly infesting Convulsions. These coverings being taken away, the substance of the brain was seen to be altogether moist, and watered above measure with a watery humour: yea, its rine or bark being taken off, all the *ventricles* were full of a limpid or clear water, of which kinde of very clear Liquor, there was judg'd to be more then half a pinte.

From these appearances, the *Pathologie* of the aforesaid feavour is easily Collected: to wit, in this sicknesse, as also in many others, the blood feavourishly growing hot, presently depotes its recrements, both into the Lungs, and into the brain; wherefore a ferous Colluvies, or watery heap, did presently overflow the constitution of either; then, because the blood being hindred, both here and there, from its due circulation, it began to grow into a very great heap, about the confines of the affected parts, and at length to stagnate, and to cause as it were a *phlegosis* or Inflammation: hence, by reason of the *serum* being plentifully heaped up in the lungs, and baked by the heat, the troublesome cough, with the thick and discoloured spittle, for the most part came in this disease; and by reason of the like affection, excited within the head, the *vertigo*, swimming, stupifaction, and other *Cephalic* passions, constantly seized on the sick: which kinde of Distempers, in this little maid, and in her brother, by reason of the infirm constitution of the brain, before in either of them, being made more greivous, terminated in an *Apoplexy*. I might easily here propose many other histories, of persons sick of this feavour at that time, but from these but now recited, the Type of the aforesaid disease, may be sufficiently known: But because the same feavour happens almost every year, on some præ-disposed; and perhaps, by reason of an evil constitution of the year, may hereafter at some time become *Epidemical*, it will be worth the while, to represent some Method about its Cure.

*The Pathologie
of the aforesaid
Feavour.*

Concerning which, first of all take notice, that in this feavour, no Critical days were to be observed, as in the vulgar continual feavours: for the blood as soon as it began to grow hot, poured out a part of the morbid matter, as yet crude, and not overcome, from its embrace to the head or breast: wherefore it were vain to expect that the blood should suffer the heterogeneous particles to be

*The Curatory
Method.*

heaped together, in its mass to a fullness, that from thence a flowing or putting forth arising, at the set intervalls of times, it might thrust the same subtilities out of doors: yea rather this growing hot glows not with a great, and open burning: but like a fire covered over with chips, sends forth a moist smoke or breath, rather than a flame: But so, that from thence, by reason of the nervous juice being depraved soon in its disposition, and not rarely, because of the lungs being stuffed with the consumptive matter, the convulsive, or phthysical or consumptive symptoms, did molest chiefly, in the whole course of the disease.

Blood to be
taken away at
the beginning
of the disease.

It behoves us to designe the curative Intentions, according to the various times of the disease, and the diversities of the symptoms chiefly urging. About the beginning of this feavour, the taking away of blood, seem'd convenient almost to all: This kinde of remedy, I often experienced with success, in little Children: For that by the means, as it were another breathing place is opened, to the mass of blood, silently and covertly growing hot, and obtruding its foot or smoak, on the more noble parts; and for that reason, its impure efflorescencies or puttings forth, are drawn away from the brain, and lungs. Therefore, although this feavour of an ill Condition, may be accounted as it were malignant, yet forasmuch as the blood is not presently apt to be coagulated, but to be too much poured forth, and to bestow its serosities on the nobler parts, to wit, the brain and lungs; therefore *Phlebotomy*, so it be administred in the beginning of the disease, is convenient almost to all.

For the same reason, *Cathartick* Medicines, and chiefly vomitory, are administred at the very beginning of the disease; for these do not only evacuate the *viscera* of concoction, and so draw away the chief fomenting of the disease, and as it were its originall, but besides, they draw forth the serosities from the blood, and so effect its cleansing, rather in the stomach and Intestines, then in the head and lungs. Further by Emeticks, for that the receiving *Glandulae* of the *Lympheducts*, are pulled with a great shaking, the superfluties of the nervous juice, least they should evilly affect the brain, and its dependencies, are expressed forth into the lower bowells: also for this end, the belly is to be kept continually loose, by the use of Clysters. But in the mean time, whilst the blood being infected with the taint of this disease, threatens the brain or *præcordia*, with the evill, it will not be safe to attempt any thing with *Diaphoreticks*, or sweating medicines, or *Diureticks* or such as evacuate by urine, or also with *Catharticks*, vomiting and purging medicines: For these kinde of medicines, forasmuch as they greatly pour out the blood, and compell its serosities into more open issuings forth, all the recrements, being apt to fall away from the mass of the blood, are easily obtruded on the brain, or Lungs, when they are of a more feeble constitution: So in the youth above-mentioned, a loss of speech, came upon the raising of an untimely sweat: Also I have known, that *Sudorificks*, no other then chaly beats, in the morbid disposition of the lungs, have brought on a waisting or Consumption.

Vomits and
Purges, are to
be admini-
stred.

Blistering
plaisters.

Diureticks.

Phlebotomy therefore, and if need be vomiting, or purging, either one or other, or both, being to be made use of at the very beginning of the disease, the other Intentions shall be, to draw away the morbid serosities of the blood, apt to flow forth on the head or breast, and to derive them gently by other ways of evacuation, and to put them forth of doors. To this end, *Vesicatories* or blistering plaisters, ought to be applyed, to the nape of the neck, or *Parotida* or *jugular Arteries*, or to the Arm-pits, or the Groin, or about the thighs, or calves of the legs, sometimes in this part, sometimes in that; to wit, that the little Ulcers being here and there excited, and continually running, might plentifully pour forth the *serum*, imbued with the morbid, and heterogeneous particles.

But Remedies, gently carrying the *serum*, into the Reins, and urinary passages, are most often administred with success: For this business, *diuretical Apozems*, and Julaps, are to be ordained after the following forms.

A diuretick
Apozem.

Take of the Roots of *Scorzonera*, cherfoil, grass, and of *Eryngoes* candied each ζ vi. 1. Apple cut, of the leaves of *pimpinell*, meadow-sweet, each i. handfull, of *Raysons of the Sun*, ζ i β . of *harts-horn*, burnt ζ ii. being cut and bruised, let them be boyled on a clear fire, in four pints of spring water, to the Consumption of the third part; to the straining being cleared ii. pints, add of the Syrrup of green *Cytorns*, or *violets* ζ ii. of *sal prunella* ζ i β . make an *Apozem*. The dose ζ iii. to vi. thrice in a day.

Or

Or into that straining, put 15 *blanched sweet Almonds*, and of the four cold seeds, each 3 i. being bruised, make an Emulsion according to Art. *An Emulsion*

Take water of *Dragons*, and of *black-Cherries* each 3 iiii. of *scordium* compound 3 ii. of *Threacle* water 3 iß. of *syrrop of Clove-gilliflowers*, 3 ii. of the spirit of *vitriol* xii. drops, make a Julap. *Julap.*

Take oftentimes in a day, in small beer or posset-drink, half a dram, or ii. scruples of *sal-prunella*. *A Power.*

Besides, in this feavour, medicines gently sweating, of that sort chiefly, which restores the animal spirits, and defends them from any heterogeneous *Copula*, are of very great use: wherefore, either the *powder of pearls*, or the *spirit of harts horn*, or of *blood*, in a moderate dose, are administred twice in a day, viz. Morning and Evening. *Gentle Diaphoreticks.*

Clysters are to be given almost every day, and if it be thought fit, a gently loosening purge, may be taken once or twice in a week. *Glisters.*

The dyet prescribed ought to be slender, as in other feavours, let them be wholly interdicted from flesh, or broath made thereof, only let the sick feed on Grewell, or barley-broth, and let their drink be small beer or posset-drink. *Dyet.*

If that notwithstanding, any preventive physick, the morbid matter, should lodge in the brain; or Lungs, or both together, so that a dissolution, or inordination of the animal function, or also a violent cough, should assalt them, it must be consider'd, what is to be done in either state of the disease, carried forth after this manner, into an evill condition; but then the curative Indications ought to respect the stupor, or madness, or cough: and lastly, if in the declination of the disease, these symptoms do remit, proper Remedies are to be adhibited, against the *Atrophie*, as it were the last fortress of this Feavour.

1st. Therefore if the morbidick matter, as it is often wont, being brought to the brain, should bring in an Insensibleness, or a soporiferous or sleepy distemper, remedies drawing it another way, and deriving it some way from the head, and besides such as stir up the animal spirits, and take away the impure *Copula* ought carefully to be administred, wherefore in this case, the use of Epispasticks or such things that draw the water outwardly, should be much increased, and let the *spirit of Harts-horn*, be exhibited almost every sixth hour, in a little bigger dose, let blood be also taken, by the sucking of Leeches, more largely from the jugular veins, the *Salvatella*, or the sedal veins. If the distemper remits not, the head being shaven, let *Emollient fomentations* be often applyed thereto: Further, let *Cupping-Glasses*, *Plaisters*, and *Cataplasms*, be laid to the soles of the feet, and other means of Administrations, such as are commonly prescribed for the curing of the stupor, or Insensibleness, ought to be used: In like manner, if on the evill, or no *Crisis* of this feavour, a phrensie, or madness should come, remedies appropriate to those distempers; are made use of. *The Curatory Method in the unsensibleness and madness.*

2dly, But if either with, or without this sort of displeasure, brought to the head, the Lungs also have taken the evill of this disease, so that the sick, not yet free from the feavour, seem to fall into a waisting, or Consumption, with a troublesome cough, with abundance of thick, and often discoloured spittle; Medicines commonly prescribed for such kinde of Distempers, are convenient enough; wherefore, pectoral Decoctions, Electuaries, syrrops, distill'd waters of milk and snails, and other remedies of the like nature, ought diligently to be made use of; the forms of which may be found, in the before-described Cases. *In the Cough.*

Thus far we have described the continual feavour, for the most part convulsive, and arising no less from the fault of the nervous juice, then of the blood: I will here further propose an example of a disease, having the likeness of an intermitting feavour, but radicated chiefly in the nervous juice; the nature of which kinde of distemper, for that it is very rare, and truly pertinent to our convulsive *Pathologie*, will appear from the following history.

A noted Woman very young, and indued with a more weak constitution of brain, and nervous stock, and for that cause very obnoxious to convulsive distempers, after she had conceived with child, about the fourth month of her being big, from cold being taken, she was grievously afflicted with Astmatical fits, and besides, with a frequent sinking down of her spirits: but by the use of remedies, indued with a volatile salt, she grew well, within a fortnights space, but after that, about 14. days, an unwonted and truly admirable distemper, fell upon this Gentlewoman. *A very rare Observation.*

One morning, awaking after an unquiet sleep that night, she felt a light shivering in all her body, as if she had had the fit of an Ague: frequent yaunings, and reachings, with an endeavour to vomit followed thereupon: then her urine, which was but now of a citron colour, and of a laudable substance, became pale, and waterish, and was rendred at every turn, to wit, almost every minute of an hour: moreover, about her loins, and *hypochondria*, and in other places, pains with light Convulsions, running about here and there, were excited: which kinde of symptoms plainly convulsive, with her frequent making of a lympid urine, continued in the Morning almost to Evening, in which space of time, a great quantity of water, at least three times more then the liquor she had taken, was rendred; in the mean time, neither was the heat great, nor did thirst trouble her, nor was her pulse encreased: In the evening the aforesaid distempers ceased, and her urine became citron colour, and moderate; and besides, all night she enjoy'd a moderate sleep, then the morning following, about the same hour, the fit returned, accompanied altogether with the like symtoms, and so dayly acted the same Tragedy.

The reason of
it.

Visiting this Gentlewoman, after she had been sick in this manner for 12. days, I framed the *Ætiologie* of the aforesaid case, to wit, that this disease, chiefly radical in the nervous stock, did depend upon the effervescency, and flux of the humour, watering the nervous parts: For it might be suspected, that this water being diffused from the blood, made degenerate by reason of the suppression of her Terms, upon the brain, and nervous stock, became more sharp, and ferous than it ought to be, and for that cause incongruous to the containing parts: wherefore, being gathered together to a plenitude, by the nights sleep, it did stir them up, or provoke them, for the expulsion of it, every where into wrinklins, and contractions: hence shiverings, yaunings, stretchings, and wandering pains, were excited in the whole body: Furthermore, from the solid parts, after this manner contracted, and shaken, not only the nervous Liquor, but also the nutritious, every where laid up in the solid parts, but not truly assimilated, were shaken off: and then, either *Latex*, being exterminated from its receptacles, and received by the veins, or Lymphaducts, or water-carrying vessells, was render'd to the Mass of blood: from whose bosome, before it had acquired a lixiviall tincture from it, being at last cast forth by the reins, constituted a clear, and Copious urine: But that this distemper observed such exact periods, the reason is, because the nervous water, being supplied with an equall dimension, did arise to a fulness of running over, dayly at the set time: Therefore also, the urine appeared concocted, and yellow, before and after the fit, because then its matter consisted only from the *serum* of the blood: Afterwards, during the convulsive fit, the limpid humour being shaken off, from the solid and nervous parts, and passing quickly thorow the blood, adulterated the colour and the quantity of the urine. I prescribed to this big-bellied woman, Phlebotomie, and besides, a powder composd out of *Corall*, *pearls*, *ivory*, and other *Cardiacks*, to be taken thrice in a day, in a proper Liquor; morning and evening she took of the *tincture* of *Antimony*, 12. drops (whose singular effect in the too great flux of urine, I have many times experienced): By the use of these, all the symptoms ceased, in a short time.

CHAPTER IX.

Of Universal Convulsions, which are wont to be excited, because of the Scorbutic disposition of the Nervous juice.

Universal
Convulsions by
reason of the
Scorbutic dis-
position of the
nervous juice.

Thus much concerning universal Convulsions, diffused thorow the whole nervous kinde, which come upon feavours; and especially concerning the Convulsions, which are wont to be excited, in the commonly called *malignant hectick Feavour*. There yet remains (which was proposed in the third place) for us to shew, by what means, and from what causes, universal Convulsions are induced, without

without poyson or feavourish infection, by reason of the scorbutick, or otherwise vitious dyscrasie or evill disposition, of the nervots juice. For indeed, the Liquor watering both the nerves, and the nervous parts, sometimes disceding from its naturall disposition, is so much stuff'd with heterogeneous and explosive particles, that the animal spirits, admitting an incongruous *Copula*, every where growing to themselves, are irritated into continuall, as it were cracklings, or convulsive explosions: These kinde of Affections of the spirits, are either divided or separated, between which no Communication, or dependency intercedes, *Two kinde of these viz. Separate and Connex or joyned together.* viz. When many parts of the body are troubled at once, with so many Convulsions proper to themselves, which do not come successively one from another, but are terminated in the same muscle or member, where they begin: After which manner, I have known some sick people, who have had their muscles and tendons, all at once in their whole body, perpetually to leap forth, with so many distinct Convulsions. Or Secondly, the Convulsive Distempers, which are excited in the whole nervous kinde together, are continued or connex, which succeed one another, with a certain perpetual vicissitude continued between themselves: Forasmuch as inordinate motions, almost of all the members, mutually relieving themselves, being risen in one part, presently passe over to others. For so *Horstius* relates of a maid, obnoxious to Convulsive motions, whose members and Limbs not only were forced into divers manner of flections and distortions, but besides, as if agitated by an evill Spirit, not being able to stand in a place, she was necessitated to run up and down here and there, and to dance, and leap in the Hot-house; nor could be hindred from it by any force or chiding, but that she would run here and there; now she would cast her self on her feet, now impetuously fling her self after another manner, for if she did endeavour never so little to be quiet, presently her *Præcordia* was most grievously afflicted. Wherefore, the Business of our present task is, to enquire a little more exactly, into the nature and Causes of either Convulsive Affection, to wit, both of that, which is affected through the very much leaping of the tendons and muscles together, and of this, which is caused through the madness and inquietudes of the members or of the whole body: that from thence it may appear, what method of healing ought to be administered in either Case.

As to the former kinde, it easily appears, that these kinde of distempers, are not simple, but complicated, to wit, of a Convulsion, and Palsie. For the muscles and tendons, are perpetually urged with Convulsive motions, notwithstanding, the sick being made weak, they are not able strongly to move any of their members, or their whole body: yea, to these Distempers, pains equally diffused thorow all the Limbs, are adjoyned. Hence we may infer, that the animal Spirits are imbued, with a manifold *Copula*, viz. both with explosive, and also narcotick or stupifying, and in some sort irritative or provoking particles: so that, although being alway burthened, they enter into explosions, yet, not many together, nor indeed any hastily or strongly are exploded, by reason of the other interjected Particles of another kinde; wherefore the motive force does not long continue, but is short, and as it were interrupted: just as if gunpowder being kneeded with some muddy substance, should be fired: for then the whole mass is not let off at once, with a noise, nor does one heap presently fire another, but a few grains only, and those successively, to wit, one a little while after another, with small crackling noises, are let off or exploded: In like manner, the nervous Liquor is stuffed thorowout, with Convulsive particles, which even cleave to the Spirits: but forasmuch, as some narcotick, and other painfull ones, are mingled with them, the elastick force of the former, however lasting, and greatly diffused, is yet much broken and every where cut off.

For the illustrating this kinde of broken convulsive Distemper, I will here describe a very notable case of a certain Gentleman lately living in this neighbourhood: which being truly admirable, not any writings or observations of Physicians, have scarce shewed the like. An honourable Gentleman whom I knew, sprung from Parents, and grandfathers obnoxious to a someways morbid disposition either of the Brain, or nerves, about the hight or beyond the strength of his Age, the fruit of this diseased Race began to punish him: for first of all, he was wont to be tormented with a debility, and numbness of his Limbs, and with light Convulsions; with which kinde of Distempers, when he had a while laboured at length,

for

for cure sake going to the Bath, having used too much the hot bathes, instead of a remedy, he brought back only an exasperation of the Disease, that from that time, the aforesaid Symptoms did not any more torment him by fits, but almost continually, to wit, the Convulsive motions, and painfull extensions, did incessantly exercise every Limb, yea, every part of his Body, so that all the muscles were perpetually drawn together, with repeated leapings all at once, and that not without great torment: The only means he had for quieting them, was to exercise his whole body, sometimes some of his members, perpetually with a local motion: for so long as he was awake, he was necessitated to be rock'd in his bed, or on his couch, or to be carried in a Coach, or to have his members press'd or rubb'd; for which end they had made for him a Bed, and a Chair set upon bow-fashon'd feet, such as are on Childrens Cradles, in which, when he lay down or sat upright, he was moved up and down continually, with a tottering or rocking motion; which unless he did, he was infested with most cruel pain, and horrid extensions of his muscles: This kinde of dayly trouble, of the Convulsive Distemper, in the night-time, and presently after sleep, entertain'd much more grievous Symptoms: for being newly awaked, his whole body presently was wont to quake, his muscles to be exercised with painfull stretchings, every Limb to be wetted with a squalid or ill-favour'd sweat, as if in the agony of Death, which was so very Corrosive, that, like *aqua fortis*, unless they presently wiped it off, it quickly eat and rotted the Linnen. The sick man, during this Conflict, was tormented for many hours, between the sweats and shiverings, untill being quite tired out, sleep creeping upon him, brought him some ease; but if at the approach of the fit, he was presently taken out of his Bed, he was better, and so prevented the wonted cruelty of the Distemper: Therefore, as soon as he was awaked from sleep, though it hapned within half an hour, immediatly to avoyd the torture, his servants being called, they took him out of his Bed: As to his Appetite he was well enough, he eat without loathing, nor was his stomach disturb'd with what he eat: Bur he did often complain of the pain of the heart, and sometimes a troublesome Spitting, with a stink in his mouth, as if he had taken *Mercury*, molested him for many days. All hot things, whether food or Physick, did nor agree with his constitution; he did not dare to taste, either wine, or strong beer: In the first years of his sickness, he abhor'd the very sight of the fire, afterwards becoming weaker; though the winter was sharp he would not sit neer the Chimny; his Urine was always of a Citron colour, which if it were evaporated in an earthen vessell, over hot coals, saltish fæculencies remained in the bottom, to above half the Liquor; his belly was continually bound, and never put forth its load, unless provoked by a purge or Clyster: Yea, besides the Convulsive motions, a Spurious Palsie possessed every member of his whole Body, for he could not lift up his hand, nor step a foot forward; his tongue shaking, brought forth his words but imperfect, but sometimes, when his minde was carried forth, by some sudden occasion of Joy, he would be able, his Spirits being raised with a wonderfull strength, suddenly to rise out of his chair, and without the help of another, to stand upright, and to jump, which interval however lasted scarce a minute of an hour, but that his members flagg'd, and were affected with their wonted languor and trembling. When this worthy Gentleman, had been sick after this manner above 12. years, and had consulted the most famous Physitians in all *England*, and had tryed very many Remedies, and almost of every kinde, viz. Antiparalytick, antiscorbutick, drying Diets, Sweating medicines, purges, Causticks, baths, Liniments, yea, and had twice tryed salivation, could finde no cure by any method of healing; wherefore, all hope of cure being wholly layd aside, for the latter seven years of his life, he made use of only Remedies, chiefly respecting some Symptoms, viz. he took thrice in a week a solutive medicine, of *Senna* and *Rubarb* with Correctives, now in form of a Syropp, or of an extract another time; every night he was wont to take a dose of an opiate, out of conserves, and temperate *Species*: Besides, as occasions serv'd, he had ready a Julap, to be taken when his Spirits fainted: moreover, he continually drunk Beer, made of oaten mault, altered with temperate and diuretical herbs. By the use of these, he pass'd over at least seven years, without any great alteration for the worse; at length, old Age coming on him, together with the disease, more cruel fits of Convulsions, not as at first after sleep, but as soon as he was warm in his bed, invaded

vaded him, that he was forced to abstain altogether from his Bed, and rarely put off his cloaths, unless to shift his Linnen: from hence transpiration being hindered, the serous Recrements, and others, wont to be evaporated, were fixed on the Lungs, which at first, brought in a frequent or short breathing, afterwards an Asthmatical Distemper, and lastly a deadly Consumption or wasting.

If the Reasons of the aforesaid Symptoms be sought after, it will be easie, to deduce all these evils from a depraved Constitution of the Brain, and nervous stock, and more immediatly from the dyscrasie, and fault, of the juice watering those parts. For when that Liquor, in which the animal Spirits, do abound, was, as to its temper, highly sharp and Corrosive, like *Stygian* water, and as to its mixture, was stuffed full of both narcotick and explosive particles, it is no wonder, because the Spirits being very much burthened, and for that cause restrained from their due expansion, that they should be forced every where into small explosions, as it were Cracklings; and that the containing bodies, being loosed from their due extension and strength, should be also continually irritated into painfull Corrugations or shrinkings up.

Those Convulsive Distempers, did more sharply infest after sleep, because the heat of the Bed, did exuscitate or stir up the heterogeneous particles of the nervous juice, and rarifying them, as it were compell'd them into explosions; then also, because the nervous parts did imbibe its juice in sleep, and a more plentiful provision of the morbid matter, brought together with it; which being filled to a plentitude, at the first instant of waking, they immediatly endeavour to shake off what is troublesome. For this Reason, it is observed, that the pains of Scorbutil people, and the fits of Asthmatical, are made worse by the heat of the bed, and by sleep; therefore as in these, presently to leave the bed, was wont to give ease, so likewise it did in our sick man: But that the trouble, excited by the continual leapings, and painfull extensions of the muscles, was somewhat allayed by the local motion, or moving from one place to another, of the body, or members, the reason is, because the Animal Spirits, whilst they are compelled to divers actions from without; they remit whatsoever inordinations are excited from within: for as in pain, and itching, which are lighter Convulsions, it helps to press, rub, or scratch the affected part, so the Convulsive motions of the muscles, and tendons, are somewhat pleased, by the inordinate agitation of the whole body, or the members.

As to the *Ptyalismus*, or copious spitting, with the stinking breath, which was wont to return at uncertain intervalls, we do suppose, that might perchance proceed from *Mercury* sometime secretly given, although I have seen many labouring both with Convulsive; and also scorbutick distempers, in whom this kinde of perpetual defluxion of spittle from the mouth, was very troublesome, without any suspicion of *Mercury*; also some (as shall be told hereafter) on whom a salivation coming (the explosive matter being after this manner Critically evacuated) help'd the disease: moreover, it is likely, that this distemper was produced from the mere recrements of the nervous juice; and that the salival passages, when many, and enough were open, did receive, and convey forth of doors, the superfluities plentifully deposited in the *glandula's*, from the nerves, and also from the Arteries.

As to the lucid Intervalls, whereby the sick man us'd to obtain some truces, though short, the cruelties as it were of the disease being mitigated, as when but now his sickness had bound him to his chair, he was able on a sudden to leap up, and walk about; but yet, this unlook'd-for strength being vanish'd, by and by falling again into his wonted languishment: I say these kinde of motions of labouring Nature, prostrate under a great burthen, are its utmost endeavours, and some more strong inforcements, to wit, whereby for a moment of time she recollects her self, and attempts as it were to shake off the yoke of the Disease; but because she is not able to sustain long this strife, she quickly relapses, and lies down under her former burthen. Truly it is a wonder, how much above the strength of Nature, Anger, and fear, and some other passions of the minde, do stretch the nervous kinde, and compell them to shew a force plainly stupendious: But these prodigies of her attempts, are only of a small duration.

The Conjunct cause of the aforesaid disease being after this manner designed, and the Reasons of the Symptoms chiefly tormenting, being shown, it remains yet

The reasons of the symptoms chiefly tormenting.

The growing worse presently after sleep whence it proceeded.

Why allayed by Motion.

The Spitting.

Why this sick man obtained some truce from pains.

The secret leading cause of the aforesaid distemper.

yet for us to inquire into the secret leading cause, to-wit, by what occasions, the nervous juice being become so degenerate, at first brings in the Palsie, and then leapings, or intestine Convulsions of all the muscles: further, we ought to explain wherefore the fruits of this Disease, increasing by little and little, came suddenly to maturity, by the use of the Baths; also wherefore this sickness yielding to no Remedies became uncurable.

As to the first, it may be said, that the sick person, being sprung from parents who were obnoxious greatly to Cephalic Diseases, had contracted originally an evill Constitution of the brain, and nervous stock, so that within the 6th lustre (i.e. about the 36th year) of his Age, he began to be sick of a spurious Palsie, then, when the evident causes daily fixing the infection more on the blood and humours, did happen upon this remote hereditary cause (for there were many chances, and unfortunate accidents, which continually brought sadness, and melancholly upon this Gentleman) indeed therefore, the nervous Liquor being imbued above measure, with a fixed and Scorbutic salt, became highly sharp and irritative, like *aqua fortis*, or the Stagma's of *Vitriol*; and so continually incited the Spirits, and the bodys containing them, into Corrugations and contractions, just as the aforesaid Liquors when poured upon worms do the same thing.

Why this Distemper grew worse by the use of the Baths.

But that this disease, leasurly at first increasing, was quickly brought into a much worse condition, by the use of the hot Bathes, the reason easily appears: It is known by experience, that the hot Bathes, do very much exalt, and quickly bring to the hight, the Sulphureous-saline particles, in the humane body, and otherwise morbid, which abound in the Bowells, and humours, viz. do render them more fierce by agitating them throughly, and force them from their first passages into the blood, and from thence into the Brain and nervous stock, yea, and joyn together those, that were before seperate, and idle, and incite them into a certain fermentation: wherefore, those who are hereditarily obnoxious to the Gout or Stone, and have not as yet suffer'd any fits of those distempers, very often feel the fruit of either disease in themselves to grow ripe soon, by the use of the Bathes: When therefore in this sick person, both the blood, and Liquor watering the Brain and nerves, were imbued both with narcotick or stupifying, and convulsive particles; and also when they did degenerate from their sweet, and balsamy Disposition, that towards a saltish, and this into a sour, Ciamul of a Stagma of *Vitriol*, the use of the hot minerall waters, was so far from bringing help, that on the contrary, these evils, for that very cause, presently grew all very much worse: and the Disease, proceeding from the humors being so depraved, as to their temper and mixture, could never be cured by any medicines, no easier than vinegar may be reduced into wine.

When this Gentlemans body, being at last dead of the *Phthisis* or *Consumption*, was opened by me, we could finde but very few foot-steps, of these kinde of most grievous Symptoms. Hence, as it appear'd, the *Palsie* and *Convulsion*, did not depend, so much on a thick and copious matter, heaped together somewhere in mines, as of an evill affection of the animal Spirits, who are subtle and invisible. I will lay forth, what was worthy taking notice of, in the anatomy of this person.

Things worthy to be noted in the body being dissected.

The *Abdomen* being opened, the *Caule* (as is wont to be in most who dye of a Consumption, and other Chronical Diseases) was putrified, and almost consumed. In the mean time, the *Ventricle*, *Intestines*, *Pancreas*, and *Mesentery*, were well enough, to wit, the membranes were firm, well coulour'd, and free from any ulcer, or hard swelling: There grew to the greater Intestines certain excrescencies like to the ears of a mouse; for that there were very many of these kinde of things out of either side of the *Colon*, and right intestine, they shewed like twins at certain distances, like the branches of Trees: The like I formerly found in a Consumptive person: The Reason of this seems to be, that the nourishment in Consumptive people, (though it be deficient about the more solid, and outward parts, yet sometimes) within neer the fountains of the nourishing juice, performs more than it ought, and for that cause, superfluous and unnaturall additions grow forth.

The milt or Spleen, which always is thought ill of, and of most Physitians condemned, for being the Principal cause of the Scurvy, and of all other distempers, appear altogether blameless, and free from any fault: For, as in most

found

people, we observed, it was of a darkish Colour, soft and of an equal *superficies*, free from any obstruction, or swelling, indued with vessels, and *fibres*, distinct, and firm enough: out of its substance, flowed black blood when it was cut.

The Liver (which indeed might be wondred at) was indifferently well, neither was it, from so long and grievous a sickness, become harder then usuall, or scirrhus, or planted with little wheelks, but it was somewhat big, and of a darkish colour.

The Kidneys, though free from any ulcer, or gravell, were not however free from fault: for in the middle of the right Kidney, was seen a great cavity, distinct from the Tunell, and much greater then it, full of clear water: the like I have very often found, in hydropical people: But indeed, this perhaps arose, from the *serum* deposited in that kidney, that could not easily be strained thorow its passages, and pores; for that the *serum* subsisting therein, had in the beginning made for it self a little den, which afterwards by degrees was enlarged; and when for this Reason, the secretion of the *serum*, and its passing forth by the *ureter*, were something hindred, its *Latex* restagnating into the blood, brought in the grievous trouble to the head; which indeed was the rather to be suspected, because also the left Kidney, being mightily extenuated, and consumed, contained many Cisterns, and Cavities full of clear water.

The Lungs, growing on every side to the *Sternum*, (or part of the breast where the ribs meet) sides, and *Diaphragma*, seem'd without any distinction of *Lobes*, of one substance only of putrid spongy flesh, stuffed throughout with a frothy or ichorous matter: without doubt, the sick man had not contracted this evill so long before, to wit, when he was not able to perform any exercise of the Body, nor stay in bed that it might breathe out any thing more freely, the faculencies and recrements of the blood, which were wont to evaporate thorow the skin, being layd up in the Lungs, were the cause, that they grew together among themselves, and with other parts, and did vitiate their tone and conformation wholly, so that, a Consumption being at last arisen, was the effect and product, and not the cause of the rest of the distempers, wherewith he had bin a long while miserably afflicted.

In either ventricle of the heart, blood was concreted into a solid whitish substance, and bak'd like flesh, which being formed neer the Cavities, and processes of the vessels of the Heart, resembled the figure of a Serpent, with a manifold divided tail: than which indeed nothing is more usual, in many dead People after long sickness: The reason of which is, that the Blood being without life, from long sickness, and from thence circulated slowly about the *Præcordia*, begins to stand or stagnate in the heart, and depending vessels, and by that means, is congealed leasurely, into this kinde of fleshy Concrete.

When the Skull was opened, we sought among its contents, the chief Cause of the Disease: The first thing that occur'd was, the bulk of the brain was less than it should be, and folded into fewer folds, from whence we suspected, that the Animal Spirits, were not plentifully enough brought forth: Further, the whole substance of the head, was more moist than it ought to be, and wholly immersed in a wet watery humour, that its Covering, *viz.* the whole meninges, were pulled asunder, and the compassing or crevices, and all the ventricles, run over with clear water: 'Tis probable, that this deluge of the Brain, had lately hapned, to wit, forasmuch, as by reason perspiration being hindred, and the Secretion of urine being but little, the serosities gathered together in the bloody mass, were carried to the head, and therefore, the substance of the Brain, and especially the chancelled or chequer'd bodies, were so wholly wetted, and soaked, that being cut, their substance could scarce remain compacted, but that it would flow away, somewhat after the manner of thick Liquids: within the bosoms overlying, and inserted to the brain, and its *Appendix*, and the vessels coming from them, the blood had concreted into little, round, hard, and as it were fleshy balls, just like those within the ventricles of the heart, and the vessels hanging to them, which also lately, when the Blood circulated slowly, we thought might happen, for the same reason, for which the blood was coagulated within the *Præcordia*.

The trunk of the Spinal marrow, being drowned in clear water, was very much extenuated, that it could scarce fill half of the bony cavity or hollownes:

which we thought to be effected, by the deluge of salt *Serum*, in which it was as it were boyled.

*The Nature,
and the man-
ner, of the
continued con-
vulsive distem-
per being made*

So much concerning universal Convulsions, which being very much conjoy-
ned with the Paralytick Distemper, are excited dividedly in many parts at once :
There remains others, which we call'd continued, because being suddenly
translated, from some parts to others, they mutually relieve one another, and
compell the members ; now these, now those, and often the whole body, to be
involuntarily moved, and diversly bended, or agitated. In these Cases, the *A-*
nimal Spirits, not only those implanted in private corners, and mines, get
to themselves an explosive *Copula*, and being some how satisfied, or irritated,
strike it off by certain turns ; but when the whole mass of the nervous Liquor,
abundantly abounds with elastick particles, they then every where cleaving to
both the Spirits implanted, and flowing in, for that reason stir them up into
Continuall Convulsions : But forasmuch, as not all the Spirits at once, are not
able, however predisposed, to be exploded, (because within the nervous pas-
sages, there is not room large enough for their so great agitations) therefore
the explosive force, arising in these, or those parts, is by and by transfer'd,
from thence, unto others, and so to others, and so like fire-draks, or wild-fire,
it runs wandringly here and there, most swiftly creeping from these Limbs, to
those, and then presently from all into the *Præcordia*, or *Viscera*, and back a-
gain. That the Image of those kinde of distempers may be known, we will
here propose some more rare Cases ; of sick persons, whom sometime past I en-
deavoured to Cure.

I. Observation.

A very fine and religious maid, tall and slender, begot of a Father sickly, and
obnoxious to most grievous Distempers of the nervous kinde ; about the 20th
year of her Age, was afflicted for many days with an head-ach, very Cruell and
periodical ; at length, at the time of the winter solstice, 1656. the pain of her
head ceased, but instead of it, a mighty Catarrh followed, with a thin and Co-
pious spitting, also an ulcerous distemper of the nose and throat ; when she had
for some time endured this trouble, at length, by the prescript of a certain Wo-
man, receiving the fume of *Amber* by a tunnell into her mouth, she was sudden-
ly cured, to wit, the Catarrh, or violent Rhume ceas'd suddenly, but from
thence she complained of a notable *Vertigo*, with a pain in the head, and of the
tingling noise of the ears : on the Third day, the tendons of the hinder part of her
neck, were pulled together, that her head was bended now forward, now back-
ward, and now of one side, sometime it continued stiff and unmoveable ; a little
after this, the same kinde of Convulsive Distemper invaded the outward mem-
bers, and Limbs of the whole body, her arms and hands were wonderfully turned
about, that no jugler or tumbler could imitate their bendings, and rollings a-
bout ; she was necessitated to spread abroad her leggs, and feet, here and there,
to strike them against one another, and to transpose or cross them by turns : Af-
ter this manner either sitting in a Chair or lying in a Bed she was perpetually af-
flicted with these Convulsive motions, unless when overwhelmed with sleep ;
and when she did a little restrain her members from the great labour of the Mus-
cles, presently she was taken with a difficult and short-breathing with a sense of
Choaking ; but in the mean time, her eyes, jaws, mouth, and lower bowells, re-
mained free from any Convulsion ; neither was she troubled with vomitiug, bel-
ching, nor any inflation of the belly, and *hypochondria* : Besides she was still her
self, and had truly the use of her memory, understanding, and phantasie, she
did, nor said any thing madly, or foolishly : but in these wonderfull evils, she
shew'd an admirable example of Christian fortitude, and patience, even with
godly and discreet speeches ; her appetite was soon lost, so that she took any
meat or aliment very unwillingly ; thirst continually troubled her, and her strength
was grown so feeble, that she could not stand or walk, her urine was of a Citron
colour, very full of saltnefs, on whose *superficies* grew little tararous skins.

When I was sent for to this Gentlewoman, on the Sixth day of her sickness, I
framed the *Ætiology* of this kinde of admirable distemper : For the considerati-
on of her father, who at that time was sick in the same house, with most grievous
Convulsive passions, kept me, that I did not with many others, refer all things
to the delusions of witches : wherefore, that I might seek out the natural Causes
of these Symptoms, it was in the first place plainly to be suspected, that this
Gentlewoman

Gentlewoman had contracted hereditarily the seeds of Convulsive Distempers; which at length, about the flower of her age, broke forth into this kinde of fruit: for when her blood was very much imbued with heterogeneous and explosive particles, they at length (as is wont in such a disposition) began to be poured into the head, and there to be fixed: being therefore first deposited in the *Meningæ*, they induced the huge periodicall head-ach; then afterwards, the same matter having accidentally shifted its place, falling down into the sincks of the throat and mouth, changed the *Cephalage* or head-ach, into a *Catarrh* or *Rhume*: and when lastly by an untimely use of the administred Remedy, the defluxion stop'd, the morbidick matter flowing back into the brain, brought the *Vertigo*; and then, being thrust forth on the nervous stock, it excited the aforefaid Convulsive Affections.

As to the formal Reason, or the means of generation, whereby the Convulsive matter, falling down into the nervous stock, did produce these admirable Symptomes, we may lawfully suppose, that the same being thrust forth from the Confines of the head, being yet more firm; into the spinal marrow; and its *Appendix*; and being like a malignant firment, it first infected; with heterogeneous and highly explosive particles, these parts of the juce watering the whole mass; which cleaving to the spirits, every where disposed thorow their whole *series*, and agitating them, as it were with a certain fury, did stir them up into continuall explosions: When in truth, the nervous juce, as is said, was so fermented by the inflowing of the Convulsive matter, that which did other ways water the containing parts, with a gentle falling on them, and through the same; did pass over the animal spirits, with an equal Expansion; now the same did torment the nervous *fibres*, with various contractions, and Corrugations or shrinkings up, and did hinder both the spirits flowing in, being too much burthened with an heterogeneous *Copula*, from their due irradiation, and also variously moving those implanted in every part, did incite them, as it were with a diabolical Inspiration, so that no more obeying the Empire of the will, they ran into inordinate motions, and did renew them, translated rapidly here and there, with a perpetuall reciprocation.

But, altho the heterogeneous particles; being poured forth with the blood, into the brain, and thence thrust forth into the nervous stock, did not enter rightly the beginnings of all the nerves, but chiefly and almost only the spinal marrow, and its nervous shoots; so that the internal *Viscera*, also the parts of the eyes, mouth, and face, remained free from any Convulsion: yet, that same explosive force, being hindred by some violence, whereby it entred less in the outward members, presently like wild-fire, a way being found, it was wont to run into the *præcordia*, and bowells of the lower belly: *viz.* because the inflowing spirits, being struck with a certain fury, and requiring a larger space, in which they might exercise their madness, being excluded from one place, presently enter another somewhere open: wherefore, if that fury had been repulsed; both from the members, and the *viscera*, no doubt but it would have flown back on the brain, and brought thither, madness, or as it were an Epileptical Insensibleness: which Symptoms indeed hapned to be wanting, for that the brain of this most ingenious Gentlewoman, being indued with a more firm Constitution, did take from the nervous Liquor freshly instilled, whatsoever was congruous and spiritous, for its proper food, and enjoy'd it: In the mean time, it did depress all the morbidic particles, into the spinal marrow, by which the involuntary motions of the members were excited, after that manner as we said but now.

Being requested to undertake the Cure of this worthy Virgin, first, a light preparation of her body being made, I gave her a solutive potion of the Infusion of *Senna* and *Rhubarb*, with *yellow Sanders* and *salt of Wormwood* added to it, by which she was purged 12 times with great ease, the next day I took viii. ounces of blood from her left Arm, every evening I gave her an opiate of the water, and Syrrup of the *flowers of Lungwort*, with the *powder of pearls*: besides; once within vi. hours, I prescrib'd her to take a dose of the *spirits of Harts-horn*, in a draught of the following Julap. Take of the *waters of black Cherries*, *Walnuts*, and the *flowers of Peony*, each ζ iii. of the Antipeleptic of *Langius* ζ ii. of the Syrrup of the *flowers of the male-peony* ζ ii. of the *powder of pearls* \mathfrak{D} i. mix it and make a Julap: because she could not endure much purging, *Clysters* with Sugar'd-milk;

The reason of
the aforefaid
case.

The Curative
Method Obser-
ved in this
case.

milk, were made use of frequently : besides antispasmodic oyntments, being applyed to the hinder part of her neck, and the back-bone, we order'd often rubbing of the distemper'd members, with warm woollen Cloaths wetted in proper oyl.

By the use of these, the sick person within 6 days, seem'd to be very much helped ; for the Convulsive motions almost wholly ceased, and she could contain her members quietly in their due position, only her head sometimes by a lighter Contractiou was compelled to bend gently this way and that way ; further she was able to stand a little, and rise out of her chair, but when she went to step forward, she went not rightly, but obliquely on one side : At this time going away, I left her much better, and in a manifest state of growing well : But after another week, when the North-winde being high, and arisen in Night time, the window not being fast shut, blew very much upon the sick person being in Bed, she presently taking cold, relapsed into that kinde of Condition, that she became obnoxious not only to Convulsive passions, but to an universal periodical palsie : for after that she was forced to move about, turn, and winde variously, all her limbs successively, with her head, and members by turns, bent, and thrown about here and there (as before) from morning to night ; till at night these kinde of motions wholly ceasing, a resolution of her members, or palsie succeeded, so that she was not able to stir either hand or foot, or any other part of her body besides, or to exereise any motive bending of the body, lying in her bed almost immovable like a stone ; but being a little refresh'd with sleep, about morning, as she recovered some little strength or virtue of the regular motive faculty, by bending, tho but weakly here and there, her arms, and legs, so also the involuntary, and Convulsive motions, did constantly return, enduring from that time, all the day, which again at the Evening, were changed into these resolutions of the Limbs.

By these it appears clearly, that the sick Gentlewoman laboured with a twofold disease, viz. a Palsie, and Convulsion, and that the material Cause of either, was somewhat distinct : For it seems, that the animal spirits, every where abounding, being burdened with narcotick particles, were almost continually bound : besides that, in the time of sleeping, together with the nervous juice, the Convulsive particles, plentifully flowing in, clove also to the spirits : for the explosions of which, the spirits being incited, produced the involuntary motions : but also at that time, the narcotic *Copula* being somewhat shaken off, they were then able in some sort to perform the voluntary or regular also : Besides the Remedies but now recited, they did carefully administer very many others, almost of every kinde, viz. Antiscorbuticks, antiparaleticks, Decoctions, sudorificks, or sweating medicines, distilled waters, spirits, Elixirs, Tincture, Baths, Liniments, with many others ; by the use of which, the Symptoms were something remitted, but yet the disease was not wholly cured, the universal palsie soon ceased, that she was able at any time to move her Limbs, and to bend them here and there ; and also the involuntary motions did trouble her but rarely, yet she continued Languishing, and weak ; and when she being of a more fine temper, and prone to a Consumption, by reason transpiration was hindred, the recrements of the bloods being laid up in the Lungs, brought in a Cough, which every day growing worse, she at length dyed of a *Phthisis* or wasting.

2. Observation. Some years since, I was sent for to a Noble Virgin, sick almost after the same manner, and something worse : For this suffer'd almost perpetually, coming by turns, involuntary motions, to wit, shakings of the head, and members, or deflections, or movings about here and there : besides, she was afflicted with an exceeding troublesome, and plainly wonderfull Convulsion, of the *Diaphragma*, and muscles serving for breathing : for every minute of an hour and oftener, her back-bone was suddenly bent in, about its middle, and together her breast shooting out forward, and her *hypochondria* being drawn inwards, she made a noysie sobbing, now double, now threefold, but still with a less and less noise : this kinde of motion, and ebbing of a crashing noise, was wont to come for many hours, and so that she might be heard through the whole house ; and when any short interval of this hapned, she was compelled presently to shake, or writhe together extreamly her arms, and hands, and sometimes her legs and feet, and also to fling about most furiously her head, and by and by to hold her neck

neck, as it were stiff and immovable: and then in speaking, her tongue would be taken after that manner, that she would repeat the same word very often, yea sometimes twenty times at least: when the Convulsive motions tormented her strongly in her outward members, she was free for a little while from that throting, and noisie distemper, and this space of intermission she call'd her time of ease; tho in the mean time, her head, and members were carried violently here and there, with Convulsive Motions: if at any time she lay on her left side, presently a contraction of her right *hypochondrium* inwards, with a sobbing or throting, vex'd her. Within a few days, her strength being very much lost, by the assiduity of the passions, she contracted so great an imbecillity in her Loyns, and joynts of her legs, that she could not stand, nor lean on her feet: Her Stomach, distemperd either with weakness, or the Convulsion, return'd back whatever was put into it, by vomit.

In this Case, as in the former, it appears, clearly, that the Animal spirits, not only those implanted in this or that part or region, had contracted an heterogeneous *Copula* to be shaken off by some turns, but also the spirits influencing some nerves, being imbued with explosive particles, had brought in the perpetuall, and wandring Convulsive Motions. And when at first it hapned, that the spirits so afflicted, did assolt, not all the nerves together, nor any indifferently, but for the most part, only those belonging to the *Diaphragma*, and the *Appendixes* of the spinal marrow, so that within those spaces, the fury of the spirits, perpetually exploding, was limited, for this reason it hapned, that the convulsive affections being restrained, in any one of those parts, did break forth more furiously strait in another; and when by their proper instinct, their motive force was imployed in one Region, the same was in the mean time, wont to be remitted in another. Moreover in this sick person, the morbid matter, consisting both of narcotick and convulsive particles, caused together the paralytick, and convulsive distemper.

Coming to her on the 4th day, I gave her an Emetick potion, by which she vomited 7 times, abundance of ropy phlegm, with yellow choller, yet without any ease: on the next day, I took six ounces of blood, from her left Arm, presently from thence, the blood being more impetuously carried, towards the head, she complained mightily of an head-ach, and giddiness; But within 3 days she being let blood in the foot, found her self better: she afterwards took Remedies for the distempers of the nerves, to wit, *Spirits of Harts-horn*, and of *blood*, *Bezoartick* and *shelly powders*, *Julaps*, and *Electuaries*, antispasmodical: by the use of these, the Symptoms seem'd to be something remitted, but yet they remained somewhat after the manner but now described. After a fortnight, by the prescription of a certain Country-Woman, she took in a draught of beer, 6 spoonfulls of *blood*, taken from the ear of an Asse, by which she seem'd on a sudden to be cured: for forthwith all the Convulsive motions did leave, and she remained free from them 24 hours; but yet the disease returning the next day, with its wonted fierceness, would not give place, neither to that Remedy, nor indeed easily to any others: she therefore for the future, took medicines methodically prescribed: Once within 6 days, she was gently purged, besides she took the powder compos'd of *Bezoar*, *pearls*, and *Corrall*, with the roots and seeds of *Paeony*, also an Electuary, prescribed by *Horstius* for these kinde of admirable Convulsions; also *Julap*, and *decoctions*, proper in convulsive Distempers: *Clysters* were often used, frictious, oyntments, and vesicatories were administred with success: within another week, the sobbing affection wholly ceased, and likewise the other convulsive motions, being grown more gentle by degrees, very much remitted: Growing well of these distempers, a *Catharr* falling down in her throat, she was so much troubled, that she almost continually spit forth a sharp, and as it were Corrosive spittle, as if she had had a salivation by taking *Mercury*: which kinde of Remedy indeed, hath been found to have been the last event in this case: but I wholly abstained from administring it, because both the sick, and her friends, would not give me leave.

After this plentiful, and troublesome spitting had continued for many days, the disease seem'd almost to be wholly Cured: so that this noble Gentlewoman, being free of her Convulsive motions, went abroad, and was well, both in strength and stomach. Only she complained, that oftentimes in a day, she

was

was suddenly afflicted, for about a minute of an hour, with a shivering of her whole body; which kinde of Distemper coming upon her sometimes in the night, broke her sleep: within the space of a month, this Symptom also, and likewise her Catarrh wholly ceased: But from thence, she was sometimes afflicted with an extream Sourness, in her ventricle, and the passage of the *Oesophagus*, and sometimes also in her mouth, and pallate, that it was feared lest the inward skin being fretted, those parts should Contract an ulcerous disposition; besides she was wont to be tormented often in her sleep, sometimes also being awake, with the night-mare or *Incubus*. For this I prescribed, *Spring* and *fall*, a gentle purge to be administred, with the use of antiscorbutick Remedies, and sometimes *Chalibiates*, or medicines of *prepared steel*, which kinde of method she observed so much to her benefit, that she was well in health for many years, and is as yet well.

Among the many Remedies, which were taken against that Sourness, and as it were ulcerous disposition of the pallat, and *Oesophagus*, I prescribed, that she should drink every morning, her own urine fresh made; this, whilst it was very Saltish, was wont to give her great ease; but at sometimes, her urine flow'd from her thin and plentifully, which being nothing salt, but like to four vinegar, from the drinking of that she received little or no benefit.

The Reason of the Case but now described, seems not much unlike the former, unless that in this sick Gentlewoman, the explosive particles had enter'd into more passages of the nerves, to wit, besides the *appendixes* of the spinall marrow, into those dedicated for the office of breathing, and also by fits, into those designed for the motion of the Tongue, and almost perpetually tormented the Spirits abounding in them, with Rage or fury.

But that the Cure of this Disease hapen'd, by the falling down of the sharp humour, into the emunctories of the mouth, and throat, we may from thence gather, that the material Cause of this, was the heterogeneous particles, and as it were nitrous, begotten in the blood; which, when from thence, being passed thorow from the brain, they were carried into the nervous stock, caused the aforesaid Distempers: But as soon as by the help of Remedies, the more plentiful provision of that matter was hinderd, and the morbidick particles already produced, both from the blood, and the Brain, and nervous stock, were derived into those emunctories of the head, the Convulsive Distemper presently ceased, and within a short time, such a Crisis or secretion still remaining, the perfect Cure of the Disease followed.

Forasmuch as the urine, being of it self very salt, and as it were lixivial, became at some times fourish, which did not give any help, as the former, to the sourness of the throat: it may hence be gathered, that the salt particles of the blood, and humours, coming away by the urine, had a twofold state or condition, to wit, of fixedness, and fluidness; wherefore the serum, imbued by them, became now of this, now of that nature: for it seems, that the Saline particles, being degenerate within the mass of the blood, remained fixed, and rendred the urine for the most part Lixivial: but those which flowed without the blood, in the nervous juce, or were laid up about the solid parts, did degenerate into a flux or acetousness: and therefore from these, being derived into the emunctuaries of the mouth, that noted sourness of the mouth, and *Oesophagus* proceeded: moreover, when these kinde of particles, being gathered to a fullness in the nervous juce, and solid parts, did swell up, and arising to a fluxion, boyled up into the blood: presently these being sent away from thence, in heaps, thorow the Reines, rendred the urine, increased in quantity, fourish. But forasmuch, as the Saline particles, being of a divers Condition, and that those of the same kinde could not be mingled together, they mutually moved against one another, and break their forces, therefore the salt urine, and not the four healed the sourness of the throat. It appears by a vulgar experiment, that the most sharp *Spirit of Vitriol*, by the mixture of the *Salt of Tartar*, or any other lixivial, grows very milde: yea, and yet from thence appears, that the acid humour, sweating out into the parts of the mouth and throat of this Gentlewoman, came near the nature of sharp *Vitriol*; because the fume of Tobacco, being taken at the mouth of the sick person, was wonderfully sweet, as it happens to such, who have beforehand tasted *Vitriol*.

Because

Because we treat here of admirable Convulsions, which do not ordinarily happen, and whose nature, and causes ly deeply hid; for the better illustration of these kinde of Distempers, we will yet shew one or two more Cases, no less wonderfull than the former.

About ten years since, I visited the daughter of a certain Nobleman, troubled ^{Observation} after that manner with Convulsive motions, that some thought her possessed with an evill Spirit: This Virgin about 16. years of age, fair, and well-made, yet begotten of a paralytick Father, without any evident Cause, about the winter-solstice began to fall ill: At first she was troubled, though not in any grievous manner, with an head-ach, and giddiness for many days; then she felt, now in one of her arms, and then in another, a trembling and sudden Contraction; which kinde of Convulsions, returning often that day, endured scarce a moment; the next day sitting nigh her Sister in a Chair, suddenly leaping out, she fetch'd one or two jumps, and many others successively, with wonderfull agility, at the distance of many feet; then, when she was come to the farther part of the Chamber, she stood leaping a great while in the same place, and every time to a great height; when her legs were quite tired with leaping, she fell on the floor, and presently she flung her head here and there with wonderfull violence, as if she would shake it from her neck: As soon as she ceased from this motion for weariness, presently the same fury invaded her hands and feet, so that she was forced strongly to exercise these members, by striking the walls or posts, or by beating the pavement: when by reason of shame or modesty, due to her friends, and by-standers, she did hinder her self with great violence, from these motions (for all the while she was her self, and spake soberly) the distemper being sent inwardly, she was very much infested, with a mighty oppression of the heart, with a bemoaning and very noisefull sobbing; then, when she would ease her self, she was forced presently, the fury being transmitted to the muscles of the outward Limbs, either to leap about, or to fling here and there cruelly her head, or arms, or also to run about the Chamber, most swiftly, or to beat the ground with her feet: because these kinde of vehement motions, of her Limbs or *viscera*, in the Tragedy of the distemper, did mutually relieve themselves, returning as it were in a round.

Coming the 5th. day after this Lady had been sick, I gave her a vomit of the ^{The Curators} fusion of *Crocus Metallorum*, wine of squills, and salt of Vitriol, by which she ^{Method.} vomited 7 times, cancker'd oile or choller, in a great plenty, with the mixture of a sharp, and as it were vitriolic humour: The next day ten ounces of blood was taken from the *Saphana* vein; besides, she took twice in a day, antidotes of the powders of pretious Stones, of humane skull, and the root of the male peony. By the use of these, within a week, she seem'd to be cured; she continued for many days afterwards free from the aforesaid distempers: But after two weeks at the time of the full Moon she fell into a relapse of the same disease more cruell than before, for besides those wonderfull leapings, and vehement Conversions and roulings about of her head and members, she was forced besides, to fetch often a most rapid course round about the Chamber: she began at this time, from the præscripts of others, to take anti-hysterical Remedies, and purges at certain set intervalls, but without any help: At last, I being sent for, because she seemed indued with a strong habit of body, and with a notable fierceness of spirits, I gave her a stronger Emetick, by which she vomited forth ten times, greenish Choller, like to rust, with phlegm, sharp like stygian water, and she was suddenly eased: After this, I gave her every morning, a draught of white-wine, dilated with the water of black Cherries, with sows or hog-lice bruised and infused therein, and strongly pressed forth. By the Use of these, she seem'd presently to be cured, and was well above a Month: And when afterwards, the distempers being about to return, she felt at any time some forerunners, presently by the use of a vomit, and the expression of the *Millepedes* or *Cheslogs*, she averted the approach of the Disease: within three months, she so far recovered her former health, that she has now liv'd for many years, free from those kinde of Convulsive distempers: But from the time the convulsive passions wholly ceased, she was sometimes troubled, about the parts of her mouth, and throat, with a defluxion, of a most sour humour, like the vitriolick *Stagma*; besides sometimes she was obnoxious to the *Pica* or longing of women, and at sometimes also to the Cough;

Cough, with a discolored spittle, threatening a Consumption, notwithstanding which, by remedies used in these kinde of Cases, she was easily cured.

*The reasons of
afore said case.*

As to the *Ætiologie*, or Rational account of the aforesaid Case, there is no reason that we should fear to refer both the Causes, and Symptoms of this disease, to the explosive particles (the brain being pass'd thorow without hurt) sent as a supply, Continually from the blood, into the nervous stock; which, forasmuch as they being poured forth in great plenty, were not restrained within private mines, to be struck off only by turns, cleaving every where, both to the implanted, and inflowing Spirits, forced them, as it were inspired with a madness, to be perpetually exploded, and to grow raging here and there, by bands: so that indeed, they were not able at all to be ruled; within the containing parts, but there was need to overthrow, and to tame them, impetuously tumultuating, and apt to be carried here and there, like a whirlwinde, by some very violent and strong exercise. In truth in was in this sick person, as it is in musical Organs, which if filled above measure, by too great a blast of winde, unless presently the passages of more Pipes be opened, the whole frame of the Organ is quickly shaken, and in danger to be broken to pieces: In like manner in this Lady, when the animal Spirits, actuating the pipes, and the depending *fibres*, of some of the nerves, were moved beyond their due tenour, there was a necessity, that their force should be bestowed on many vehement local motions together, whilst they inflated above measure the nervous bodies: wherefore, when their madness was hindred in on part, by and by like winde pent up, creeping somewhere else, it broke forth more violently, in some other part.

In this sick person, the use of one or two Vomits, brought help once or twice, because that by it, what was lodged in the gallie-vessell, yea the *glandula's* and emunctuories, and also about the *viscera* of concoction, being by this means emptied, the purging of the blood, and nervous juce, were more Copiously drawn into the same place; therefore indeed, that the animal Spirits, flowing within the Pipes of the distemperd nerves, might be less infected by them: By this reason also, the juice of the Sows or hog-lice was beneficial, forasmuch as it derived the morbidick matter, from the nervous kinde, to the urinary passages: Besides these Remedies, the Root and in a great part the branches of the morbidick matter being cut off, and when others, as it were antidotes, hindring every where its vegetation, were carefully administred, whatsoever was left of it, Nature at length becoming superior (as she is wont in these criticall Cases) sent away, to the sinks of the mouth and Throat.

4. Observation.

Whilst I was writing these things, I visited an illustrious Virgin, who was troubled with other kinde of Convulsive motions, and those universal, and no less to be admired: she was about 18. years of age, handsome, and well made, and before this time healthfull; when the Pestilence raging in this neighbourhood, she had come within the danger of its Contagion, she fell into a panick fear, with frequent swooning; the night following, she suffer'd so great a *deliquium* or sinking down of her Spirits, and insensibility, that she seem'd just a dying: hardly struggling with so great an evill, afterwards she had every day Convulsive fits, though at first at uncertain hours, and returning after a manifold Kinde: But within a short time, its comings being made regular, twice in a day, to wit, they constantly returned at eleven of the clock, and before five in the afternoon, that no intermitting feavour, kept more exactly its periods; yea, also, the same accidents of the fit daily chanced after the same manner.

When she had thus been sick for three weeks, one day I was sent for, that I might take notice of all the Symptoms, and the whole figure of the disease: she being up about ten in the morning, was well, in her Countenance, going, and speech, she behaved her self exceeding well, so that none would ever suspect her to be sick: at eleven of the clock, she began to complain of a fullness of her head, and numbness of Spirits, with a light swimming; by and by she felt a great pulsation, and as it were the leaping of some live animal, in her left *hypochondrium*: putting my hand on her side I plainly perceived this motion; then a stretching and belching followed, which done, she was presently put to bed, and a maid sitting upon a pillow held her down; who during the fit, most strictly graspt the sick person, holding her to her bosom, with her arms foulded about her waist: besides servants were ready, and her relations standing by, who now press'd down her

her

her belly, and *hypochondria* rising up, and swelling to a great bulk, now held her hands and arms. The chief Symptoms of the Disease, which being excited by turns, almost divided the whole fit, were these two, *viz.* one while Cruel Convulsions of the Bowells did infest her, so that the *abdomen*, rising up into a mighty bulk, strove against the hands of the by-standers, held upon it, that it could not be pressed down; and at the same time, her *Præcordia*, being contracted upwards, the motions of her blood and heart, were almost stop't: in which space of time, this virgin, her head falling down, with a small pulse, and almost without voice, lay nigh senseless; after two or three minutes of an hour, these Convulsions ceased: and then the sick person, setting her self upright, look'd about cheerfully, and for a while, the force of the disease changed into talking and singing, both of which she without ceasing performed, most pleasantly and most elegantly, beyond her proper capacity: with these kinde of speeches, and pleasant jaests, she fell upon all the standers by, that nothing in a Comedy could be more pleasant; then she utterd most sweet tunes of musick, and more pleasant, than any other could, or her self at another time: After she had past fix or seven minutes of an hour, thus jesting and singing, the Convulsions of her Bowells and *Præcordia*, and the want of speech, came upon her as before: and these soon remitting, the force of the Spirits leaping back, from the inferior nerves on the brain, it was lastly imployed in the pleasantness of speech and Songs; as often, when she talkt to the by-standers, as any of them replied any thing bitterly or reproachfully, she fell into those most grievous, and longer continuing, Convulsions of the *Viscera*: After this manner, she was wont to be molested, with an alternate distemper of the Bowells, and brain, about the space of an hour: Then towards the end of the *Viscera*, the fit declining, more light Convulsions being made, they repeated three or four times without any intermission, then these wholly ceasing, the force of the disease brake forth into her outward members, from whence it quickly vanished: for her Arms and Legs, for a minute of an hour, suffer'd leapings forth, and Contractions; presently after, the sick person being taken up, left her bed, free from all Convulsion, till a new fit returned; yea, indifferently well in strength, she walk'd about the house, and during the interval of her distemper, she cheerfully performed the accustomed Offices of Life, excepting that her stomach languishings all day she loathed food, in the evening, after the second fit, she sup'd moderately.

This was the present state of the Disease, in whose fits, the more clear use of some faculties, seem'd in a manner to Compensate the irregularity of others: But about the beginning of her sickness, it was somewhat otherways: for the Convulsions of her bowells, were far more grievous, and an insensibility was joyned to them: besides, in their intervall, talking idly, an incongruous singing, yea both laughter and weeping, without any known reason, breaking forth, were wont to follow one another: but now, the animal Spirits being forced into longer explosions, performed them so regularly, now this, now that, as a more Commodious way was made, that they seemed after a manner, to be done by the Command of the will, and of Reason.

That we may therefore, according to our *hypothesis*, frame an *Ætiology* or rational account of this Distemper; In the first place, it seems, that a vehement fear, did drive the Spirits inhabiting the brain and *Præcordia*, into great disorders: so that, they being disturbed out of their ranks, both the kinde of madness or foolishness, and the frequent swooning succeeded: Further, it may be suspected, that from the same impression, the hurt was carried to the brain it self, so that its conformation being somewhat vitiated, the heterogeneous and morbid particles, were admitted together with the nervous juice: Then, although the spirits at the beginning, being confused and troubled, after their short inordinations, at last recovered themselves, and performed the wonted offices both of the animal and vital function; yet by reason of the taint, impressed on the brain, the heterogeneous particles being constantly admitted, cleaving to those Spirits, induced explosive endeavors, as soon as the spirits were filled to a plentitude, with the extraneous *Copula*, they being irritated, entred into Convulsive explosions for the shaking or striking it off.

*The reasons of
the aforesaid
Distemper.*

About the beginning of the Disease, when both the Disposition of the Brain,
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and the Spirits inhabiting it, was more perverse, and vitious, from the fresh received hurt, a fullness of the heterogeneous *Copula* sooner happened, and so its explosion following more often, and more inordinately, was dispatched with greater tumult; But afterwards, when the hurt of the animal regiment abating, the supplements of that *Copula*, even as the nervous Liquor, were daily brought in with an equal dimention, the explosions of the Spirits being made regular, and more milde, observed their just periods or set times.

That she felt, upon the approach of the fit, a fullness and as it were an inflation in her head, with an heaviness, and dullness of the spirits, the Reason is, because at this time, the spirits inhabiting the brain, being now prepared for explosions, were wont first of all to be moved, and as it were to swell up; then that pulsation in her left *hypochondria* succeeded; for that the Spirits inhabiting the nervous foldings, and *fibres*, thickly planted about the Spleen, began to be exploded: afterwards, when the Spirits flowing both within the mesenteric, and Cardiac enfoldings, were exploded together, those elevations, and as it were leapings up of the *Abdomen*, and *Thorax*, were induced: and when in this distemper, the motions of the blood and heart were almost wholly stopped, therefore there was a small and almost no pulse, and she became Speechless, and in a manner senseless.

The Convulsion of the *Viscera* and *Præcordia* remitting, a prattling and singing succeeded, because a falling down or removal of the Spirits as yet exploded, being made from the nervous stock, into the brain, it changed the Convulsions into an exaltation of the fancy, and more ready exercise of the phantasms, or Representation of the Imagination: So long as the Spirits, within the middle of the brain, are regularly and orderly exploded, they bring forth the Acts of the habits and faculties so much more noble, and as it were above the strength, and tenour of Nature, as in this sick Gentlewoman: but on the contrary, when the explosions of the Spirits in that Region, happen to be inordinate, they cause for the most part foolishness, or at least the exercise of their powers, are incongruous and absurd.

The Convulsions of the Bowels, and the phantastic actions, releiv'd one another mutually, and by turns, because plenty of Spirits, being disposed to be struck off, made their tendency, as it were with a direct and reflected waving or undulation, now on this part, now on that by turns: then lastly, when they were almost all exploded, the more often Convulsions of the *Viscera* were stir'd up; and when a small handfull only remained to be exploded, that being at last excluded, both from the head and bowels, it ran forth into the spinal marrow, and employed the last assolt of the disease, in the Convulsions of the Arms and Legs.

There yet remains one great difficulty in this Case, why the fits of this disease, were always repeated exactly at set hours, and yet had so unequal periods, to wit, that the Coming of the first, was only but six hours before the second, and then the return of the next, did not hapen but in 18 hours space. For the solving of this, it is to be supposed, that these fits did depend upon the nervous juice being stuffed to a plenitude, with heterogenous particles: which particles were altogether conveyed thither from the bloody mass, and the blood did drink up the same, from the nourishing juice, sent as a supply from the Bowels: These being thus supposed, we must consider, in what space of time, the bloody mass is filled with those morbid particles, and then, in what measure, it pours them forth into the nervous Liquor. As to these, that it may the better appear after what manner it was done, in the case of this sick person, you must know, that she took in 24. hours space, only at one time, a full meal: to wit, after the second fit was ended she supped moderately about 7 of the Clock; the rest of the day wanting an Appetite, she hardly took any food, therefore it is probable, that the morbid matter, was poured forth together with the nutritious provision, into the bloody mass, chiefly in the night time; and that more plentifully, than that all could presently be derived, into the nervous Liquor: The heterogeneous particles, which are first conveyed from the blood, newly satisfied, into the nervous Liquor, being heaped up to the fullness, did excite the first fit, the coming of which therefore was longer delayed, because both one space is required wherein the blood, and then another wherein the brain and nerves, are to be filled: after this fit was over, because the blood yet full, containing in it self more particles

particles, of the same kinde, pours them suddenly on the nervous juice, therefore the other fit is induced, within thrice the space of the former : but this being ended, because both the bloody mass, and the nervous juice, are wholly freed from their burthen, the sick person finding her self better, than at any other time, took her food greedily enough ; but after that, when to the next following fit, first the bloody mass, and then the nervous juice, ought to be filled with the morbid matter, therefore 10. hours are required for this double task : but forasmuch, as there is only need, for the second fit, that the other particles should be derived from the bloody mass, yet full, into the nervous juice, therefore for this effect, a much less space doth suffice, viz. of 6 hours.

After I had seen this Lady, who had labour'd for many weeks with these kinde of periodical fits, I order'd, that three hours before the second fit, ten ounces of blood, should be taken out of the vein on the foot ; which being done, the coming of the fit, in the evening being expected, quite left her, neither did it return at all afterwards ; but the other fit, observing its former time, daily returned, till the Patient being let blood, a little before its coming, remained that day free from the disease, which however returning the day after, according to the same manner, exercised her for many months : In the mean time, because the cold of the winter was very great, she forbore for some time the use of remedies : but the spring coming on, this honourable Lady being brought to Oxford, was Cured by the following method. *The Curator's Method.*

First I gave her this Cathartick, and I took care, that it was repeated every 6th. or 7th. day. Take of the *Sulphur of Antimony*, grains 6, of *Mercurius dulcis* 1. scruple, of the *Resine of Julap* gr. iv. of *ginger* gr. vi. let them be beaten together in a mortar, then adde of the *Conserves of Violets* 1. dram, make a *bolus* : It was wont to provoke two or three vomits, and three or four stools. The flux of her Terms came constantly in great abundance, at the set times : wherefore, when the blood seem'd very plentiful, and hot, I order'd *phlebotomy* twice or thrice in the midst betwixt the times of her Terms : Besides, every day that she did not purge, she took twice in a day, 4 pills of the following mass, drinking after them, a little draught of the Julap below prescribed. Take of the *Roots of the male-Paony*, ʒ ʒ. of *Virginian Snakeweed*, *Contrayerva*, *Cretic Dittany*, each ʒ i i. of *humane skull*, prepared, ʒ i ʒ. of an *Elks claw* ʒ i. of *red Corral* prepared, of the *powder of Pearls*, each ʒ i. of the *salt of Wormwood*, ʒ ii. of the *salt of Corral* ʒ i. with what will suffice of the *syrrop of the flowers of the male-paony* make a mass.

Take of the water of the *flowers of the male-paony*, of *black Cherries*, and of *Wallnuts*, each ʒ iii. of the antiepileptic of *Langius*, ʒ ii. of the *syrrop of the flowers of Paony*, ʒ i ʒ. of *Castor* tyed in a knot, and hung in the glass, ʒ i. mix them, and make a Julap.

When she began to loath the Pills, they being omitted, she took twice a day, to wit, in the Morning, and the Evening. about one scruple of the following powder, in a spoonfull of Julap, drinking after it 4. or 5. spoonfulls of the same. Take of *Bezar-stone*, of either *white Amber*, of *Pearls* prepared, of *red Corral*, each ʒ i. of *humane skull* ʒ ii. of the root of *Virginian Snakeweed*, and the *seeds of Rue*, each ʒ ʒ. mingle them, and make a powder, let her take ʒ i. Morning and Evening, with a dose of the above-prescribed Julap.

Then, when also this medicine began to be tedious to her, she used the pills, or the *Elixir proprietatis*, and also sometimes for many days the *Spirits of Harts-horn* : At last, she began to be helped, by that powder, being daily taken, for some space.

In the mean time, whilst this method of healing was ordained ; her hair being shaven from her head, it was covered only with a thin covering : She wore upon her Belly, an Hysterical plaister mixed with *Galbanum* : for her ordinary drink, she took a *Bochet of Sarsa*, and *China*, the roots of the *male-Paony*, and other proper things, infused in *Spring-water* and boyled. Within a month, the Fits were something remitted : then, being by degrees made gentler and lesser, at length they almost quite ceased : unless that at the time of her Terms, one or two fits of the disease was wont to trouble her : Further she labour'd with an almost constant giddiness, and queasiness of Stomach ; in the middle of the Summer, she drunk *Astrop-waters*, for a fortnight, and was perfectly well.

But as for the means in generall, to be shown for the Cure, of these admirable

it will not be easie to assigne, either fit remedies for this herculean disease, or a certain method of Cure, approved by often experience : for besides, that these like cases are seldome met with, it is likewise observed, that the same Medicines which at this time were helpfull to this sick person, being given to another, or to the same, helpt nothing at another time : The reason of which seems to be, because the cause of the Disease consists in the disordinate, or evill disposition of the nervous juice, which Liquor, is not always perverted, after one and the same manner : But by the manifold combination of the salts and Sulphures, it gets a morbid nature of a various manner and kinde, and oftentimes changes it : wherefore, in the most grievous distempers of this kinde, not the vulgar medicines, taken from the shops or dispensatory, are to be prescribed, but magistralls, as cause arises, according to the appearances of the admirable Symptoms. A gentle vomit, Purge, blood-letting, ought in the first place to be ordained, and to be repeated, as often as shall seem fit. As to specifick medicines also, and appropriate in these cases, when the chief Indication shall be, to mend the temper of the Nervous juice, you may try many, and by their effect judge of their virtues : Therefore it may be lawfull, to try, what the Remedies indued with a volatile or armoniac salt, may effect. For this end, the spirits and salts, of Harts-horn, Blood, foot, and the flowers and spirits of *Sal-armoniac*, are taken : These helping nothing, you must come to Chalybiats or Steel medicines ; the tinctures and solutions of Corall and Antimony are given : which kinde of medicines are exhibited, in such a dose, and form, and so often, that some alteration may be made by them, on the whole blood or nervous juice : Further, If successe shall fail in such like, you must then proceed to *Alexipharmaca*, which help against poysons, and the malignancy impressed on the humours : to wit, to institute from these, decoctions, and distilled waters of vegetables, powders, Conserves, and other preparations ; and to compound variously some with others, and to administer them diversly. It is likely, that those kinde of medicines, which are wont to be helpfull to such, as are bitten by a viper, or a mad Dog, or that have taken woulfs-bane, or poyson, may be usefull also in the aforesaid Convulsions. It may be lawfull here, according to the example of *Gregory Horstius*, in his tract of the malignant Convulsive disease, and also of wonderfull Convulsions, to prescribe magisterial Remedies, in the form of a purging Electuary, and also of a powder, and Convulsive Antidote, and to compound them variously, partly of simple *Alexipharmacks*, or poyson resisters, and partly of *Antiepilepticks*, or things good against the falling Evil.

CHAPTER. X.

Of the Passions Commonly called Hystericall.

THE hysterical passion is of so ill fame, among the Diseases belonging to women, that like one half damn'd, it bears the faults of many other Distempers : For when at any time, a sickness happens in a womans body, of an unusual manner, or more occult original, so that its Cause lyes hid, and the Curatory Indication is altogether uncertain, presently we accuse the evill influence of the womb, (which for the most part is innocent) and in every unusual Symptom, we declare it to be something hysterical, and so to this Scope, which oftentimes is only the subterfuge of Ignorance, the medical Intentions, and use of Remedies are directed.

A description of the hysterical passion.

The Passions, which are wont to be referred to this cense or order, are found to be various and manifold ; which rarely happen in diverse women, or which come wholly after the same manner : The most Common, and which commonly are said to constitute the formal Reason of the hysterical distemper, are these, viz. A motion in the bottom of the belly, and an ascension of the same, as it were a certain round thing ; then a belching, or a striving to vomit, a distention, and murmur of the *hypochondria*, with a breaking forth of blasts of winde, an unequal breathing, and very much hindred, a choaking in the throat, a

vertigo,

vertigo, an inversion, or rolling about of the eyes, oftentimes laughing, or weeping, absurd talking, sometimes want of speech, and motionless, with an obscure or no pulse, and deadish aspect, sometimes Convulsive motions, in the face and Limbs, and sometimes in the whole body, are excited: But universal Convulsions rarely happen, and not unless this disease be in the very worst state: Because, for the most part, the Tragedy of the Fit is acted without Contraction of the members, only in the inferior belly, *Thorax*, and head, to wit, in some of them, or successively in all: women of every age, and Condition, are obnoxious to these kinde of Distempers, to wit, Rich and poor, Virgins, wives, and widdows: I have observed those Symptoms in maids before ripe age, also in old women after their flowers have left them; yea, sometimes the same kinde of Passions infest men, as plainly appeared by the example already shewed.

As to the causes of those symptoms, most ancient, and indeed Modern Physicians, refer them to the ascent of the womb, and vapours elevated from it: The former opinion, although it plead antiquity, seems the less probable, for that the body of the womb is of so small bulk, in virgins, and widdows, and is so strictly tyed by the neighbouring parts round about, that it cannot of it self be moved, or ascend from its place, nor could its motion be felt, if there were any: as to that vulgar opinion, or Reason taken from the vapours, we have often rejected it as wholly vain, and light, for just reasons elsewhere: But we judge, the passions but now described, do neither always, nor at all proceed from the ascent, or the vapours of the womb: and that indeed, other very famous Physicians, have already determined: For in times past. *Charles Piso*, and of late the most learned *Highmore*, have vindicated the womb from all fault; and the passions, which are commonly call'd hysterical, are thought by this latter to arise from the blood, most impetuously rushing on the Lungs; and by the other, from a ferous colluives heaped together neer the *origin* of the Nerves. How probable this latter opinion doth seem, shall appear from what follows: But as to the opinion deliver'd by Doctor *Highmore*, concerning this thing, tho it be far from our Custom to contradict any ones opinion, and that it is almost unlawfull for me, to dissent from this famous man; yet, because our Pathologic standing on a contrary *basis*, (viz. the cause of the hysterical distemper being imputed more immediately to the nervous stock, than to the blood) will seem to be only asserted, unless we shew the Reasons, which combat against that *hypothesis*, and forours, therefore taking leave, here we will try more exactly either opinion, put as it were in a ballance.

In the fit therefore commonly called hysterical, this famous man supposes, the blood, for that it is thin, flatulent, and with a certain effervescency, to rush too much in heaps, into the pneumonick vessels, and the vessels of the heart, and in them to broyl up impetuously, and so to stuff up the lungs, and very much to aggravate them, that neither they can exercise their motion, nor that the blood can be drained from the bosom of the heart: Hence, from the blood stagnating in the *Præordia*, a great oppression, difficult breathing, and often none, with a melting of the vital Spirits were wont to be inferred: then the *diaphragma*, that it might give place to the Lungs more and more distended; and that breathing at least might be some way made, is carried downward, with a mighty and long continued *Diaστοle*, and so by pressing down the Intestines, it lifts up the *abdomen*, and *hypochondria*, and feins a motion as it were the arising of a globe: But afterwards, the vital function labouring after this manner, the animal faculty arises in its aide, wherefore, a necessity of motions, in various parts urging the animal Spirits, being driven impetuously into the beginnings of the nerves, produce divers manners of Convulsions, running here and there. The Author endeavours to confirm this Opinion, by the great help in this disease had, by the taking away the bloody excretion, both from things helpfull, and things hurtfull, in this passion.

But though I cannot but praise this Doctrine of the suffocation of the womb, as very ingenious, and cunningly wrought, yet that I do not consent to it in all things, some reasons of great moment clearly hinder me. Truly I confess, that I do not understand, how in some hysterical persons, to wit, who are of a more frigid temperament, and are often troubled with the *Pica*, and longing disease; the blood should so immoderately boyl up in the Lungs, without any conspicuous

notes of its growing hot, in some other place. I have known young maids, by reason of the green-sickness, as it were without blood, to wit, whose blood indeed being without life, did remain without any exercise in the heart, and was from thence diffcultly enough drawn forth, into the Lungs, who yet were grievously obnoxious to the passions called hysterical: Certainly it is not probable, that the blood of these persons growing immoderately hot, should rush impetuously into the Pneumonick vessels, and should stuff up their pores and passages very thickly, when in the mean time, such become short-breath'd, by reason of the absence of the blood from the Lungs, or its difficult admission to them: Besides, by what means comes it to pass, that this violent course of the blood into the Lungs, which is supposed to be made in this Fit, brings forth no Inflammation in them? for that the blood, being too much heaped, or rapidly put into any part, is easily extravasated, and is wont to excite an Inflammation hardly to be shaken off. From whence it is therefore, in the hysterical distemper, the blood entering violently into the Lungs, and distending them, does not cause a peripneumonic or Impostume of the Lungs? Or wherefore the distempers as it were hysterical, come not on an Inflammation of the Lungs, otherwise caused? wherefore it seems improbable, that the blood swelling up, with its proper anger or heat, should rush into the Lungs, and by stuffing them, renders them too immovable, and so secondarily and consequently induce Convulsions of the *Diaphragma*, and other parts: but it may rather seem, that by reason of the *Diaphragma*, and other organs of breathing, being first affected with a Convulsion, the blood should be forced to stagnate in the *præcordia*: Besides, it may be observ'd, that the Lungs are not always afflicted before other parts; for oftentimes the convulsive Symptoms begin elsewhere, and not rarely bear the region of the breast wholly untouch'd: Because in some, the *vertigo*, and Coruscations or sparklings of the eyes, begin the fit, to which succeed either weeping, or laughing, or convulsive motions of the Limbs, without any straitness of the breath, or oppression of the heart: in others, before respiration troubles them, any way, a swelling in the bottom of the belly, with a vomiting, and rumbling of the belly, begins and often ends the fit; so that the difficulty of breathing, oftentimes follows these Symptoms at a great distance, and is wont to be prevented, by the tying strictly of swathing-bands, about the *hypochondria*. Moreover, it seems, that this ascent as it were of a certain round thing, from the *Hypogastrium* or lower part of the belly, can never proceed from the depression of the *Diaphragma*; because in the hysterical fit, this part is not always pressed down towards the lower parts, but oftentimes drawn up to the higher parts, and drives the Lungs upwards, so that the spirit or breath being almost shut forth, threatens the danger of Choaking. By these, and other reasons, we are at length perswaded to that opinion, that the distemper named from the womb, is chiefly and primarily convulsive, and chiefly depends on the brain and the nervous stock being affected, and whatever inordination, or irregularity from thence happens, about the motion of the blood, is only secondary, and is made dependingly, by the Convulsions of the Bowells.

The hysterical distemper chiefly belongs to the Brain and nervous stock.

But that this doth consist within the bounds of the head, both the comparing of the symptoms, which happen in the living, and the anatomical observations of the dead, clearly shew; because we may observe, that this distemper often takes its rise, from a sudden fear, great sadness, or anger, or other violent passion, in which the spirits inhabiting the brain are chiefly affected besides, to some an ill manner of dyet, and various accidents whereby the humours being vitiated, are heaped more plentifully within the head, at first brings this evil. Yea, the manner of the fits clearly evinces the same, forasmuch, as a fullness of the head, a *vertigo*, a sparkling of the eyes, a ringing noise of the ears, begin in many the hysterical fit, and often conclude it: Besides I have opened some women, dead of other diseases, tho while they were sick, very obnoxious to hysterical passions, in whom the womb being very well, I have found in the hinder part of the head, the beginnings of the nerves, moistned and wholly drowned with a sharp serum, as shall be more largely declared anon.

Having weighed these, and other Reasons, we doubt not to assert, the Passions commonly called Hysterical, to arise most often, for that the animal spirits, possessing the beginning of the Nerves within the head, are infected with some taint;

taint; to wit, they being either acted or brought into Confusion, or being tainted with vitious humours, get to themselves an heterogeneous and explosive *Copula*, which they carry far away with themselves, into the Channels of the nerves: and when the same spirits are filled to a plenitude, with that *Copula*, thorow all their *series* or orders, either of their own accord, or being occasionally moved, they enter into explosions, and so stir up Convulsive motions: But that such a *Copula* adhering to the spirits, is chiefly derived together with them, into the interior nerves, the reason is, because in this passage towards the *præcordia*, and *viscera*, the animal spirits, by reason of the distemper of the minde, are very much disturbed; wherefore, they more easily admit any evils brought from another place, and more readily conceive irregularities. For the animal spirits, chiefly for this occasion, contract a convulsive disposition: forasmuch as they, from a violent impression, are perverted out of their Courses, and their wonted manner of Influence, and acting; hence they not only repeat their inordinations, but also receive the heterogenous particles into their embraces, and more easily combine with them: Wherefore, forasmuch as the animal spirits, running thorow the nerves of the wandering pair, and Intercostals, are continually entangled with all perturbations both of the Concupiscible, and irascible Appetite, it is no wonder, if they acquire a convulsive disposition, before the rest.

It being supposed (which indeed ought to be supposed) that the animal spirits have contracted an heterogenous and explosive *Copula*, now the nervous *origines*, and carried it together with it self into the interior nerves, and spread it thorow all their passages, it will not be hard to assigne the Reasons of the hysterical fit, and of all its Symptoms. For first of all, the disease being ready to fall upon one, oftentimes the *Vertigo*, a rolling about of the eyes, and a certain inflation of the brain, as it were prævious skirmishings, are stirred up, because the whole band of the Spirits, being inreadiness for explosions, the more light companies of them, leaping back towards the brain, are first struck off; then Presently a perturbation succeeds, in the bottom of the belly, or *hypochondria*, for that the Spirits within the enfoldings here and there, are next disturbed: For we have elsewhere shown, if at any time the animal Spirits are exploded, in a certain whole *Series*, those which abode in the extream parts, first of all enter into that assertion: Wherefore the beginnings of this Disease, are found to be or the most Part, in the head and Bowells: but that the Convulsions are first perceived, now in the bottom of the belly, now in the *hypochondria*, the reason is, because the morbid matter, is sometimes carried by the passage of the intercostal nerve, into the utmost mesenteric enfoldings; but sometimes the same, being slid down, not beyond the ends of the wandering pair, subsists much neerer, to wit, about the enfoldings of the spleen, or stomach.

When therefore the animal Spirits (as hath been shown) within the nervs of the wandering pair, and intercostals, are imbued from their *origine*, even to their utmost ends, with an heterogeneous and explosive *Copula*; they at length, either from mere fullness, or by an irritation somewhere made, are stirred up to explosions; in which affection, if any Spirits leap forth towards the middle of the brain, they induce the *Vertigo*, the inflation and other prævious accidents of the head: but the Spirits inhabiting the other extremity of the nervous Trunk, viz. the mesenteric enfoldings begin chiefly to be exploded, which presently by their letting off, compell the lower Parts of the *hypogastrium* to be lifted up, and contracted upwards, and so induce the ascension of a certain bulk, as it were of the womb: then, when the upper parts of the enfoldings of the mesentory, are by degrees intangled with the same distemper, and the bowells annexed to the same are elevated, and drawn forceably towards the upper parts, the violent swelling of the *Abdomen*, as it were with a certain leaping forth succeeds: Further, the Ventricle is not only elevated, by changing its place, all its *fibres*, to wit, the direct, oblique, and transverse, being affected at once, with the Convulsion, is often distended like a blown bladder: hence very often vomiting, or at least a rumbling, and murmur of the *hypochondria*, are excited: but as soon as the Spirits being exploded, with a certain *series*, it comes to the Region of the *Thorax*, the *diaphragma* being drawn together, with an huge diastole is sometimes depressed, and so meeting with the ascension of the *viscera*, causes an Inflation, and high intumescency or swelling up, with a mighty struggling; so that

The cause of the disease, most often begins, about the beginning of the nerves.

The same cause afterwards disposed, thorow the whole passage of the Nerves.

The reason of the hysterical symptoms unfolded.

the laces of those in this distemper, must be forthwith loosned, or else they are in danger of falling into a trance : In the mean time, the *Diaphragma* being so depressed, and its diastole continued, the blood remains almost immovable in the *præcordia* : and so by its stagnation, causes a great oppression, and very often a failing of the vital function : Further, the Convulsion of the *Diaphragma*, happens sometimes towards the upper parts, and so, that driving the Lungs upwards induces a violent Systole, and protracted longer than it should be ; and when by this means, the blood is driven forward, into the pneumonic vessels, and is not at last received from the bosome of the heart, it stagnates there, and besides in the whole Body ; from whence the oppression of the heart, and oftentimes a swooning, yea sometimes a want of speech, and motion, now with a blewness of the face, and now with a dead aspect follow : After these things are acted in the lower, and middle Region, at length the distemper reaches to the head, by the passage of the nerves, as it were a fiery inkindling, and the spirits being there exploded leaping now towards the middle of the brain, produce a swimming in the head, and often symptoms very like the *Epilepsy* ; sometimes the spirits there exploded, rush into the beginnings of the other Nerves, and there stir up the like explosions ; wherefore, hysterical people, towards the end of the fit, often Laugh, or weep, or talk Idly ; sometimes the parts of the face, and mouth, yea, sometimes the arms, and other members, are troubled with convulsive motions, and so, when at length all the spirits, which had contracted an heterogeneous *Copula*, are exploded, the fit ends ; but presently after, matter for another fit ; begins to be gathered together.

From whence
the diversity
of the symp-
toms happens.

It sometimes happens, that the convulsive disposition is not drawn out so long, and largely, for besides that oftentimes the nerves only of the wandring pair, and the intercostalls are troubled with it, that neither the brain, nor the outward members, are at all molested ; yea sometime, neither the interior nerves themselves, are possessed with the morbific cause, thorow their whole processes : for the convulsive Disposition (as we but now intimated) oftentimes arrives not beyond the enfoldings of the spleen, or stomach, and then the fit beginning from the inflation of the *ventricle*, or left *hypocondrium*, is thought to arise, not from the fault of the womb, but of the spleen : which kinde of distemper, by and by being brought to the Thorax, and there involving the *Diaphragma*, and Lungs, with a Convulsion, stops respiration, and the motion of the heart, or in some manner perverts it : but then from thence, the fit passes over ; now with, and now without a great perturbation of the Head. These things happen indeed after a various manner, according as it happens, that the morbific matter, or explosive *Copula*, descending from the head, is gathered together, as it were heaps of gun-powder, more or less, now in this, now in that part ! But concerning which matter, by what means, the same being brought forth in the head, first affects the beginnings of the nerves, and so constitutes the procatartick, or more remote Cause of the passion called Hysterical, now remains next to be inquired into.

The more re-
mote Cause of
the disease
subsists, either
nigh the be-
ginnings of the
Nerves.

As to the morbific matter or explosive *Copula*, which cleaving to the spirits, flowing within the head, and with them derived into the nervous passages, is often the cause of the distempers, commonly termed of the Womb ; we say, that this, as in other kinds of Convulsions, is the heterogeneous particles, poured forth from the blood, which yet are wont to be affixed to the spirits, flowing into the beginnings of the nerves, chiefly for two causes : to wit, either by the fault of the spirits themselves, or by the force of the matter it self, instances of either kinde, are ordinarily met with. It sometimes happens, that the animal spirits, planted within the brain, and in the passage leading from it, to the *præcordia*, are very much disturbed, by a sudden passion, as of fear, anger, sadness, &c. And forced into disorders ; and that by that means, they being driven out of their orders, do acquire to themselves heterogeneous particles, wherever met with ; and combine with these, that by and by, for that reason, they acquire an explosive disposition, as we have already declared. Further in the second place, sometimes the morbific matter it self, being made more fierce and strong, in spite of the succour of the animal *Æconomie* or rule, is poured forth into the brain, and its appendix, from the bloody mass, which cleaving fast to the spirits, presently disposes them into explosions : This is ordinarily discerned

in the evil crises of feavours, also in some malignant distempers, also in Scorbutic and other Chronical diseases ill cured. An ill, or weak constitution of the brain, or nervous stock, whether it be hereditarie, or acquired by reason of an ill manner of living, very much cherishes these causes. For in bodies so disposed, both the animal spirits, from every light occasion, are moved in Confusion; and the passages of the brain, and nervous *System*, more easily lye open, for the running in of the heterogeneous, and explosive matter. In truth, for this reason, women are more obnoxious to convulsive distempers, than men, and some women then others, as we will shew more largely hereafter.

But altho these kinde of passions of women, called hysterical, most often proceed from the fault of the head, or from the morbidic cause, arising within the *Encephalon*; yet sometimes, such distempers are stirred up, by reason of a Cause ^{Or near the} beginning somewhere else, *viz.* Now in the womb, now in the other Bowells; ^{womb, or other} and of this Convulsive Pathologie, there are chiefly two heads, *viz.* ^{Inwards.}

1st. Sometimes it happens, that a Tumour, or an ulcer, or a congestion of sharp humours, arises in the membranous parts, about the womb, or planted ^{This last hap-} about the other *Viscera*, and often irritates the parts so distemper'd, by reason ^{pens after a} of the breaking of the union, into painfull Convulsions: then forasmuch as the ^{twofold man-} animal spirits, placed round about, and those inflowing, are moved into fre- ^{quent disorders,} they at length, getting to themselves heterogeneous particles, ^{sent either from the distemper'd part, or from some other place, are disposed to} convulsive assaults, and when first of all, the convulsive motions happen only in the neighbourhood of the affected place, to wit, that the bulk ascending in the lower part of the belly, or its swelling up be only perceived; afterwards they are propagated by the passage of the nervous bodies, and by the consent of the convulsion there begun, leasurely into the other *viscera*, of the lower belly, then to the *præcordia*, and lastly into the head it self; and the distemper, being thus by little and little delated to the spirits inhabiting the brain, they moreover having gotten in their proper Sphear, an heterogeneous *Copula*, retort the same back to the *viscera*, and so the morbidic cause, being made reciprocal, is begun at either end of the nervous Trunk. Some time past I have seen a noble virgin, in whom a small Tumour arising, with most cruel pain, below the *Os pubis*, did stir up huge Convulsions; first in the lower belly, and afterwards ascending to the *Præcordia*, and head, were at length stretch'd to the outward members: for once or twice in a day, after that great pains did torment her in the affected part, the *abdomen*, and by and by the *hypochondria*, were wont to be lifted up: then difficulty of breathing, on an Insensibility succeeded, and presently the distemper being brought outwardly, most horrid Convulsions, and Contractions of the members, and Limbs followed. Sometimes it also happens, that convulsive symptoms are induced in Child-bearing women; by reason of some hurt or evill brought to the womb: *Harvie* Relates, that wonderfull convulsions were caused by the injection of some sharp thing into the womb: So sometimes, tho rarely, it happens, that a morbidic matter or explosive *Copula* is fixed to the spirits dwelling about the extremities of the nerves and near the womb, immediately from the place there affected and without fault of the brain.

There yet remains another case, or manner of affecting, by which the convulsive disposition is produced from the fault or the parts, lodg'd at a great distance from the brain (tho in the mean time, the taint, which is the cause of this distemper, is often mediately communicated to the brain it self) to wit, when at any time, the nervous juice is hindred somewhere, in its motion or circulation, from thence stagnating in the nervous parts, and loading them, does often bring in a convulsive disposition: So, when some usual Evacuation, whereby the superfluities of the nervous Liquor, were wont to be sifted forth, is stopp'd, as from Issues suddenly shut up, or old ulcers dryed up without a purge, many fall into convulsive distempers: Yea, it may obtain here some place, what is wont commonly to be noted for a cause, of the hysterical passions, in maids and widdows, to wit, the untimely restraint of the feminall humour, which ought to be bestowed about the pleasure of *Venus*; at least, if they receive help from the state of a conjugal Life, it therefore happens, because the restagnations of the nervous humour, which often fix a taint to the brain and nervous stock, by this means are prevented: Moreover, the nervous juice flows back towards its beginning,

ning, because its passage is somewhere shut up, by a swelling or cancrus Tumour. Lastly in this City, a notable instance of this kinde of distemper hapned, *viz.* A certain maid of 12. years of age, had contracted an *hernia* or burstness, hence by the order of her Mother, she wore a truss ill fitted, for a fortnight, not without great pain and torment, a little hard knot much pressing upon the *glandulas* of the Groin : within this space (when before she was perfectly well) she began to complain of a giddiness and heavy dulness of her head ; and so a little after, she felt convulsive, and as it were hysterical distempers, frequently falling upon her ; together with it great swellings arose behinde her ears, and in her neck of the same side, to which she was never before obnoxious in all her life. It is not to be doubted in this case, but that from those *Glandulas*, which are the Emunctuaries, or sinks of the nervous Liquor, being too much pressed together, the superfluities of that humour, wont to be sent away from thence, by the Lymphatic vessels, restagnating in the head, brought forth those evils : because the arising of the aforesaid symptoms, so suddenly and manifestly followed, upon the wearing of that Truss upon the Groin, that even her Mother laid the cause of the Disease, upon that occasion. Besides also I have observed in others, the recrements of the nervous humour, being somewhere stopp'd in their Course, restagnating towards the head, have not only brought in convulsive symptoms, but from thence the *Kings Evil*.

Objections against the aforesaid hypothesis answered.

So much for the formal Reason, of the different original of the distemper, called hysterical ; as also of the *genuine* Causes, of its symptoms : Out of which, it seems to appear plainly, that those passions, do not depend always on the womb, but much more often, on the fault of the brain, and of other parts of the nervous stock : But many things are objected against these, which according to the old opinion, cast all the blame on the womb : To wit, it seems so to be done because the assault of this disease invades almost only women ; yea and women that are not well about their womb, *viz.* Child-bearing women, or such who have their courses stopt, are chiefly obnoxious to it : Besides it may be argued from things helpfull for it, because a plaister worn upon the lower part of the belly, also a strict girding of the belly, and *hypochondria*, by which the ascent of the womb may be hindred, do not seldom drive away the fit, just falling on them ; this also shews it, that sweet things held to the nose brings on the fit, and stinking things drive the same away, it is said to happen quite contrary, if the same things be laid to the belly, or privy member.

That we may wipe off these objections, we say first, that the symptoms, which seem hysterical, do not only happen to women : for we have shown already, by the history brought by us, that a certain man has been obnoxious to those kinde of fits, with the ascension of a bulk in the bottom of the belly : but that women are much more often troubled with those convulsive diseases than men, two reasons may be shown, *viz.* First, for that their animal constitution is much weaker : to wit, they have the brain and nerves softer, and of a less firm texture, that they are not able to suffer any thing strongly, or to resist every injury ; also the animal spirits in them, being more prone to flight and distraction, more easily admit an heterogeneous and explosive *Copula* : from hence Women, from any sudden terror or great sadness, fall into mighty disorder of spirits, when men from the same occasion, are scarcely disturb'd at all. Secondly, women more readily receive the convulsive disposition, because they gather a more plentiful heap of the morbid matter : for that, whilst they lead for the most part a sedentary Life, the blood, for want of ventilation, becomes more impure ; besides in this sex it originally abounds with heterogeneous and fermentative particles ; wherefore it is convenient for it, to be more often purged, by the flux of their Courses ; by which notwithstanding, not always what is extraneous, and incongruous, is wholly cast forth, from the bloody Mass, but that there remains, that which being poured on the brain, and its appendix, as occasion is given, becomes the cause of the convulsive distemper : Moreover, when the menstrual flux, being stop'd, a convulsive disposition is occasioned, it is not therefore to be thought, that such a distemper is rais'd up from the womb, but that the bloody mass, being more than usually imbued, with heterogeneous particles, carries them, together with the nervous juice, to the head : yea, chiefly for this reason also, child-bearing women, are found obnoxious to the passions,

passions, as it were hysterical, for besides that the membranes of the womb being hurt, a convulsion there begun, by reason of the felt trouble; creeps upwards and is at last communicated to the head; it most often happens, that the blood being infected, by the termes being retained, grows hot with a feavourish burning, and then instead of a *crisis*, the malignant infection, is carried to the brain, from whence convulsive, and not seldom soporiferous, or sleepy distempers, are excited.

But that it is argued, that this disease seems to be hysterical, because Remedies applyed about the *abdomen*, often bring help; it will be easy to shew, that the morbid cause planted in the mesentery, oftner than in the womb, is sometimes either taken away by that means, or restrained from its Influence: besides, the same kinde of applications, about the *hypogastrium*, are no less profitable, altho the original of the distemper, be derived from the head it self: for we have shewn before, that when the heterogeneous, and explosive matter, descending from the head, brings a convulsive disposition, to the spirits disposed within the whole processes of the interior nerves; the convulsive motions therefore excited, begin from the extremities of the nerves, and so creep upwards towards their beginnings; so that first of all the *viscera* of the lower belly, then the *præcordia*, and lastly the brain it self are affected; but if the outmost spirits, *viz.* those dwelling in the enfoldings of the mesentery, be restrained from entering into explosions, all the rest, in the remaining nervous passage, continue in their orders: and this, plaisters worn upon the navel, do often effect: for they repress, and compel into order, with their odour, the spirits from leaping forth; yea also, not seldom, they shake off and drive away, the *Copula* cleaving to them: wherefore, when the explosions there about to be made, are restrained, the convulsive fit is wholly prevented: which yet is more apparent, for that, if the Convulsion begun in the lower belly, and from thence ascending like a Globe, be presently suppressed, and by a strong binding together of those parts, it be hindered that it creep not upwards, oftentimes the convulsive passion is broken off, the *præcordia*, and the brain being untouch'd: wherefore it is a common custome, for sick women, to binde strictly the *Epigastrium*, with swaths or rollers, and so to stop the progress of the symptoms, towards the upper parts: For when the animal spirits, enter into Convulsions successively, as it were a fiery enkindling, wherever the tinder, or cherishing matter is cut off, or intercepted, the distemper is there restrained.

As to the various effects of odors, to wit, that sweet things bring on the fit; but stinking things drive the same away, it may be said, that the former do loosen the animal spirits, by pleasing them, and too much release them from their wonted tasks of Influence, and so provoke them ready to be exploded, in such disorders, yea and as a flame put to them, do somewhat inkindle them: but on the contrary, stinking things repress the spirits, drive them back from excursions, and exorbitances, and compell them into order; yea like sulphur, mixt with *aurum fulminans*, take away from them their explosive force.

What we have hitherto said, of the passions called from the womb hysterical, will yet more clearly appear, if for the Confirmation of our *Hypothesis*, we shall add arguments taken from anatomical observations; I will therefore lay before you a notable Case, by which the former reason, and Causes of the convulsive distempers, may be very much illustrated.

A very noble Lady of a most curious shape, and highly indued with a virtuous *Observation*, disposition, of minde and manners, of late lived near to this place, who being for many years obnoxious to convulsive distempers, for that she had originally, or hereditarily contracted this sickly disposition, and had experienc'd the fruits of this morbid seed, almost every lustre of her age, but chiefly as often as she was with child, (for she very frequently miscarried) was wont to be tormented above measure, with convulsive passions, as it were hysterical; because, presently after the restraint of her monthly flows, the heterogeneous particles being translated to the brain and nervous stock, caused fits of this most cruell distemper.

After she had newly conceived, in the first months, according to her old custom, she was presently molested with convulsive distempers; about the ninth week of her big belly, from taking cold, she fell into a dangerous feavour, in which very

acute pains tormenting her, in her loyns and bottom of her belly, for many days, seem'd to threaten an abortion: but these pains, as the event shew'd, rather to be termed Colical, proceeded from a sharp humour, falling down into those parts, from the brain, by the pipes of the nerves; for towards the declining of the feavour, this matter being somewhere else translated, a great looseness or Diarrhæa, pains of the feet, and as it were an ulcerous disposition succeeded.

As soon as this Lady became well from her feavour, and those pains, the convulsive distempers returned, for every morning, waking from sleep, she was wont to suffer Convulsions, and cruel contractions, about the parts of her face and mouth, as also in her armes and thighs; which symptoms, without doubt, did arise from a serous heap or gathering, laid up in the head, about the beginnings of the nerves; and by them imbibed, together with the nervous juice, more deeply in sleep; and when afterwards the same matter, was carried by the pipe of the interior nerves, into the foldings of the Mesentery, and loyns, most cruel pains of those parts, and also fits as it were hysterical, did most grievously infect her.

But these convulsive motions of her face and members, after a little time ceased, but yet she still remained weak, and without strength, with a pale countenance, an infirm and trembling gate, and desirous only of congruous food, and hot Liquors: about the end of the third month, at which time she was wont continually to miscarry, her *menstrua* broke forth, which coming away for two or three days together, with little pieces of broken membranes, she expected to miscarry: But that flux ceasing, pains as it were of one in labour, in her *abdomen* and loyns, as before arose, and for the space of a week, tormented her day and night; at length, having used a bath of *Emollient* herbs, and afterwards put to bed to sweat, she brought forth the burthen of her womb: the conception so coming away with mighty pain, was about the bigness, and like the figure of a Turkie egg: the exterior coat of it was torn and broken, the interior remaining whole, contained about half a pint of clear water and nothing else besides; there appeared no shape of a childe, or any rudiments that it would ever be one: Afterwards for 4. or 5. days, her flowers flowed forth, with some pieces of broken membranes: in the mean time, pains with their wonted fierceness tormented her, and when the space of a week being elapsed, they left not off of themselves, remedies at length were sought to allay them.

To this end, first Liniments, Fomentations, Baths, and Clysters, were often administred; also medicines purging the filth of the womb, on which the cause of all the evill was cast, were taken inwardly: Short intermissions of her tortures, followed upon the use of the former; but then the distemper returned, with great trouble; yea the disease much increasing, in three weeks time, got many other horrid symptoms: for besides the pains in her belly and loyns, which became more cruel every day, also she was shortly after tormented in her back, neck, shoulders, as also in her arms and thighs, with most cruell pain; and that more bitterly, as soon as she was warm in her bed; besides, she was afflicted with a frequent giddiness, vomiting, and nauseousness, and often in a day, with most grievous convulsive fits, *viz.* First a bulk was seen to ascend in the bottom of her belly, and presently it lifted up her whole belly forceably, by and by respiration being restrained, an Insensibility, with a dead countenance succeeded: after that, she had thus lain as one dead, for three or four minuts of an hour, she was wont suddenly to leap up, that she could hardly be held down, or kept by those standing by; then follow'd cruell contractions, and distortions in all the parts of the mouth, and face, as also in all the members of the body: These symptoms were indeed judg'd to be hysterical, because this noble Lady so lately had miscarried.

But weighing every one of these, I was at last of this opinion, that the cause of either fit, *viz.* Both the *dolorifick*, and the convulsive, did depend wholly on the evill affection of the brain, and nervous stock, and that without any fault of the womb; for that a sharp humour, being heaped up within the head, did from thence descend thorow the passages of the Nerves, into parts at a great distance; which lodging upon the membranes and *fibres*, and fermenting with the humour, flowing in from the bloody mass, did irritate them very much, and so stir'd up most cruel pains: Then afterwards, when the heterogeneous and explosive particles,

ticles, being admitted with what humour within the head, and entering into the nervous passages, did cleave to the spirits; therefore the convulsive disposition, then breaking forth into grievous fits, was induced, as shall be by and by more largely laid open.

Instituting Curatory Intentions, according to this kinde of *Ætiology*, I order'd to have blood taken from this sick Lady, at what time she most grievously laboured, out of the *Saphena vein*, and within two days, to be given her a gentle Cathartick, and that to be reiterated, once or twice in a week: Also on other days, Morning and Evening, I gave her spirits of *Harts-horn*, and at other hours, twice or thrice in a day, of the powder of *Pearls* and *Crabs-eyes*, with a dose of the following Julap. Take of the water of *Snails*, and of *worms magisterial* each ζ iii. of *Saxifrage*, and *black cherries* each ζ iiii. of *hysterical water* ζ ii. of the *syrrop of Coralls* ζ i β . of the *tincture of Castor* ζ i. mingle them: The bath of sweet herbs was frequently used, when necessity urged, she took *Opiats* always with good success: *Vesicatories* were applyed to the inward part of either thigh, also to the hinder part of her neck; also *Fomentations*, *Oyntments*, *Clysters*, *Cuping-glasses*, *Sneezing-powders*, with many other manner of administrations were prescribed, according to the exigences of the symptoms.

By this method observed for about 14. days, the noble Lady having received very much ease, was wholly rid of her convulsive fits. Yea, the torments of her Bowells and members, and the other symptoms being very much lessen'd, she hoped quickly to recover her health: But after this, partly by reason of an ill order of dyet, which the sick Lady always indulg'd her self in, or taking little, but chiefly, by reason of a sudden passion of fear and sadness, which an unluckie accident hapning within her own house, had caused, she fell into a relaps, by and by the disease growing into a much worse Condition, for both the Convulsions, and pains, did infest her more bitterly; yea and her stomach being almost tyred out, with continual vomiting, would not admit either of food or medicines. She took Asses milk for some days, with some success; which notwithstanding, for as much as breeding Choller in her stomach, she found it troublesome, she shortly omitted: at length in spite of all Remedies, prescribed carefully by the Consultation of many Physitians, my noble patient from day to day grew worse, and by degrees death approached: Two days before her death, the torments of her belly and loyns very much abated, and she became more than usually chearfull, and conceived some hope of Recovery; But in the mean time she complained of a pain and great heavyness in her head; and about the beginning of the night she slept soundly, but being awakened she fell into a very horrid convulsive fit, which presently pass'd into a quick deadly *Apoplexie*, for being made insensible, and speechless, she left this life within twelve hours.

When various judgments had passed, about the cause of the sickness, of which this illustrious Lady dyed, most flinging all the evils on the distemper of the womb, others on an Ulcer or Imposthum, which they suspected lay hid, somewhere about the *viscera* of the *abdomen*; it pleased her friends, that her dead Carcase, kept long opened for the Funeral, should be dilligently inspected, and so the genuine Causes of the disease, and her death, might be investigated; which task being left to my care, I executed with all the dilligence I was able.

Therefore in the first place, it was worth observation, about the habit of the body, that the members and lower parts, nigh and beyond the seats of the pains, were very much wasted; as her thighs, quite worn away, appeared like a Skelliton: In the mean time, her face, neck, and arms, remained full, and plump enough: from whence it appears, that the nervous Liquor, does help no less to the business of nourishment, than to the exercise of the animal faculty: wherefore, when that Liquor, being much hindred in its passage, the loyns and belly, taken up with the continual Convulsions, did not descend, with a due influx, to the inferior parts, they for that reason, became presently both without strength, and lean, and wasted. This kinde of Atrophie, differs in this, from other hectical wasting, which happens from the vice of the blood, because in this latter, an hippocratick or wanish face, is the chief signe of the Disease, in that first mention'd, the countenance, and aspect, show little or nothing of evill.

The dead body of this noble Lady, tho very lean, and that her bowells were all

The rational account of the disease taken from anatomical Observations.

all the emptied, yet quickly putrified, for within 40. hours all the skin was discolour'd, and appeared in this part livid, in that green, and in others blackish; and her Corps so suddenly putrifying, yielded a most horrid smell, the reason of which without doubt was, that by reason the muscles were exercised with perpetual Convulsions, the principles of their mixture, were so much loosned, that they being in a readiness for dissolution, quickly after death, fell asunder one from another, after the like manner, as we may observe of the flesh of wilde beasts, which being tyred with a long course, or beaten to death with Clubs, for this much sooner putrifies, then the flesh of those, which are kill'd quickly, and peaceably:

Her belly being opened, the Intestines, and ventricle appeared whole enough, viz. Intire and well colour'd, but they were emptie, and as it were blown up, for as much as they were troubled, almost with perpetual evacuations, viz. Those placed above or below: in all this Cavity, no foot steps of an Ulcer, or Imposthum were perceived. Whilst we were searching the cause of the disease, and rolling the Inwards here and there, there was something met within the mesentery, worthy notice, to wit, about its middle, where it is fixed to the back, and contained the greater folds of the nerves, a substance somewhat loose, and inflated, as it were with many little bladders, equalling an hands breadth, was seen, after that manner, as when in a shoulder of Veal, the inter-space of the muscles, are blown up, by the Butchers, that those parts might swell up, and seem fuller, and fatter: In this place of the mesentery, because it was more tumid and softer, we thought some humour, the cause of the pain, to lodg there, but opening it, I found only the membranes to have been loosned one from another, and to conclude nothing but winde, within its inter-spaces: which separation of the membranes, and devulsion one from another was without doubt induced, by the frequent Convulsions or explosions of the spirits, which within the enfoldings, and nervous fibres, there thickly planted, were almost continually provoked; and those Convulsions hapned, by reason of the heterogeneous, and explosive particles being derived thither, from the head, by the pipe of the Nerves.

But as to those torments of the belly, and as it were an ascent of a bulk or substance in the convulsive distempers, and the inflation of the *Abdomen*, it is not to be doubted, but that the seat of the morbid cause, did lye hid in that part of the mesentery: but because so much suspicion was had of the womb, being chiefly affected, we did next inquire how much this Inward deserv'd it: Therefore having dilligently searched the tunnell, placed within the *Os pubis*, I found the womb in its due place, and as to all parts sound, and well furnished: its body was drawn to its just proportion, altho it was but 5. weeks since she had miscarried, viz. It was like a small pear in figure and magnitude; the *Glandulas* on either side of the bottom of it, which are called the testicles, appeared very small and flaggy, without any superfluous or virulent humour contained in them: the body of the womb, wherever it was dissected, equal'd a thumbs breadth in thickness, its inward Cavity was no bigger than what would hold a bean: within this hollownes, as use to be in the Caverns of other Inwards, was included a mucous or dreggy matter, in a very small quantity: but in truth, about the womb, or its *appendix*, there was nothing, to which might be imputed as a morbid cause, of the symptoms but now described: from whence therefore it may be demonstratively concluded, as I at first thought, that the passions termed from the womb hysterical, are most often excited, from some other cause, than the fault of the womb.

The Intestines being removed, we found also the reins sound enough, but one of them was of an unusual figure, viz. It was cleft into many lobes, like the Kidney of a Calf.

The *Milt*, *Pancreas*, and *Caul* without fault: the *ventricle* was much blown up, and its inward Coat was plain without folds, or wrinkles, which certainly hapned, by reason of its frequent Vomiting, this Inward being almost continually troubled with Convulsions: Besides, for this reason, the tone of the stomach being broken, it did neither rightly desire, or concoct the food, or aliment.

The *Liver* very much differ'd from a sound constitution, for it was tumid, and somewhat hard, of a pail colour, like rotten wood, wholly dry and without blood,

blood, and this without doubt, the frequent use of Cordiall, and highly hot liquors had effected.

The *Lungs* were of a blewish colour, and every where obstructed, and stuff'd with a stinking and frothy matter: Certainly this Inward and the Liver had been vitiated of a long time, wherefore as the blood being degenerate, and very much depraved of a long time, from its right temper, had yielded the first seeds of this sickness, so also it afforded a constant cherishment of it.

But indeed, we sought, and that not in vain, for the chief and as it were originall cause of the disease, in the head; therefore the skull being taken off, the vessells of the *Meningæ*, and those creeping about the brain, appeared full, and distended with blood, when in the rest of the body, scarce any blood had flowed forth, in the cutting of it: the thicker *méninge* being removed, thorow the other thin and pellucid one, was discerned a clear water, filling the enfoldings and crevices of the brain, and as it were overflowing its whole substance: In truth the serous heap of waters, had filled full all the Cavities, and inward places of the brain: the enfoldings of the *choroides*, or net-like membranes of the brain, being a long while immersed in water, and as it were boyled, were become discolour'd and half rotten: nigh to the beginning of the Splanchnick nerves, or belonging to the Spleen, the water insinuating it self very much, had separated the *pia mater* from the trunk of the oblong marrow or pith, for two fingers breadth: without doubt, the morbid matter descending from the head, by the passage of these nerves, into the enfolding of the mesentery, was the cause of the pains and Convulsions: Further, the same matter also, afflicting the heads of other nerves, and passing thorow their pipes, produced afterwards, these most cruel distempers in other parts, to wit, almost every where, of the whole body.

As to the Cure, or means of healing, used in the passions commonly called *The Method* Hysterical: forasmuch as the symptoms of this disease are very much convulsive, of *Curling the* therefore it is fit, that anti-spasmodic or anti-convulsive Remedies, such as were *hysterical distempers* before described, should be chiefly indicated; but when these distempers most often happen to the female sex, in whom for the most part, the menstrual flux, and other accidents of the womb do challenge a part in the morbid cause; therefore medicines respecting the various dispositions of the womb, are to be added to the former, and many ways to be compounded with them. The Therapeutic or Curatory Indications, are either Curatory, to be administer'd in the fit; or preservatory which are instituted out of the fit, that take away the cause of the disease, and prevent its comings or accessions.

1. As to the first, if the fit is wont to be light, and without other perturbation of the spirits, it may be permitted to pass away of it self; but if it being more heavily troublesome, there will be need to bring some help to nature much oppressed, this only thing is to be done, that the spirits being freed from the Embraces of an heterogeneous *Copula*, they may remit their inordinations and explosions: for this purpose, it is grown into use, to put to the nose stinking, and ill smelling things, the scents of which compell, and repress the too fierce spirits, ready to leap forth, into their orders, and also shake off from them, the heterogeneous *Copula*, and often drive it quite away: *Asafetida*, *Castor*, *Galbanum*, being put into fine Linnen and applyed to the nostrills are convenient; also burning of *Partridge feathers*, *old skins*, and *sulphur*. Besides the spirits and *oyl of sut*, or of *Harts-horn* do not seldome help: yet I have known these kinde of fumigations, being very troublesome to some women, to increase the fit; it is probable that the same sometimes may too much irritate the spirits, and drive them into greater disorders; and as stinking things put to the nose, so the like poured into the mouth, do often bring help: wherefore we give often with good success, to hysterical people, *Tinctures of Castor*, *Solutions of Asafetida*, and *Galbanum*, *Spirits of Harts-horn*, and *Sut*, with proper waters. Take of the *Spirits of Harts-horn*, from 12. to 15. and 20. drops, let them be taken in a little draught of the following Julap. Take of the *waters of penny Royall*, and *mugwort*, each ζ iii. of the *water of Briony* compound ζ ii. of *Castor* tyed in a knot and hung in the glass ζ ss. of the whitest sugar ζ i. mix them: Take of the *Tincture of Castor* \mathfrak{z} i. to ζ ss. let it be taken in a little draught of small beer. Take of *Asafetida*, and *Galbanum* ζ ii. let it be dissolved in *spirit of wine* to the extraction of a red tincture.

The

The dose \mathfrak{z} i. in two or three spoonfulls of *featherfew water*. *Riverius* very much crys up that of *Solenander*. Take of musk, and of *dragons-blood*, each \mathfrak{z} i. take more or less of it in water of *Lillies of the Valley*; \mathfrak{z} iii. or iiiii. *John Anglicus* commends *parsnip-seeds*, or the seeds of *Penny-royal* in wine, or other proper Liquor, as a most certain Remedy. If the fit persisting a long time; should cause want of speech, or motion, the more sharp Clysters, as of *bryony-Roots*, and *Carminatives* boyled in water, are to be administred, and frictions of the thighs, and feet are to be order'd; and if they shall yet grow stronger, Cupping-glassies are to be applied to the belly and groin, yea also, let them be often provoked to sneezing: it is convenient to give some, in the middle of the fit; a draught of simple cold water, or in which *Champhir* had been dissolved.

Preservatory.

2. The preservatory Indication comprehends these three Intentions, viz. In the first place to take away, or to derive to some other place the impurities of the blood, apt to be poured forth on the brain, and nervous stock. Secondly, to fortifie the brain, and so to strengthen the indwelling spirits, that they may either not at all receive, or may easily shake off the heterogeneous *Copula*. Thirdly, to amend whatsoever is enormous in the womb, and contributes to the convulsive disposition.

1. The first Intention is performed by purging, and phlebotomy, and other common ways of purifying, and purging the blood and humours. If there be opportunity for an emetic, I judge it best allways to begin with it, especially in *Cacochymicks*, or bodies full of evill humors, in the longing disease, and *Pica*, and in such whose great load of viscus phlegm, stuffed within the folds and coats of the ventricle, hinders the virtues of other medicines: The next day after the Vomit, unless any thing bids the contrary, let blood be taken, in women of a hotter temper, presently from the Arm, and afterwards if need be, from the foot, or from the sedal veins with Leeches; but in bodies troubled with obstructions, and less hot, let blood be taken more sparingly, and more rarely, and only in places scituate below the womb: After these Evacuations (if they are to be ordered) rightly performed, once within six or seven days, a purge is to be prescribed according to the following forms. Take of *pill-fetida major*, \mathfrak{z} i β . of the *resine of Jalap* xii. grains of *Tartar Vitriolat*, and *Castor*, each \mathfrak{z} i. of *ammoniac* dissolved in hysterical water, what will suffice to make xii. pills, for iii. doses. Or take of the *resine of Jalap* gr. xviii. of *Calomelaus* \mathfrak{z} i. of *Castor* \mathfrak{z} i. make a powder, let it be divided into iii. parts for iii. doses, let it be given in the pap of a roasted apple, or in *Conserves of Borage*: so those induced with a more hot temperament, a dose of extract, or our solutive syrrop may conveniently be administred: for the revulsion of the morbid matter from the head, Issues made in the calf of the leg, or thigh, and sometimes vesicatories, legatures, and painfull rubbings, are wont to be administred: But not only a purging of the blood, and a revulsion of its recrements from the head, but an alteration of its Liquor, and reduction of it to its due temperament have here a place: Wherefore in some hysterical people, steel Medicines help, in others the use of Spaw-waters, or whay, in others the baths are wont to be signally profitable.

The second Intention, to wit, the rectification of the brain, and animal spirits, is performed with Cephalic, and properly anti-convulsive medicines: which indeed ate to be diligently exhibited, almost every day, when they do not purge or bleed: since there are various *species* of such like Remedies, and several manners of administrations, we will here add some of the more choice forms.

Take of the Lees of *bryony*, *Assa fetida*, *Crstor*, each \mathfrak{z} i. of the *Salt of Coral*, *Amber*, *Tin*, each \mathfrak{z} β . of *Galbanum* dissolved in hysterical water, what will suffice to make a Mass: dose, half a scruple, to \mathfrak{z} i. morning and evening, drinking after it a dose of proper liquors.

Or, Take of the seeds of *Wilde-parsnips*, of *nettles* each \mathfrak{z} ii. of *vitriol of Steel* \mathfrak{z} i. of the extract of *Gentium*, *featherfew*, each \mathfrak{z} i β . with what will suffice of the syrrop of *Mugwort*, make a mass, let half a dram be taken after the same manner.

If the form of a powder pleases better; Take of the *Roots of Virginian Snake-weed*, and *Contrayerva*, each \mathfrak{z} i β . of *Coral* prepared, of *Pearls*; of *white-Amber*, each \mathfrak{z} i. mingle them, make a powder: Dose \mathfrak{z} i. to half a dram, morning and evening, with an appropriat Liquor.

Opiats are Composed after this manner. Take of the *Conserves of the flowers* of

of the Lilly *Convallis*, of the male-peony, of betony, each ζ ii. of the seeds of Peony, of red Coral prepared, each ζ ii. of the powder of Cretic Dittany ζ i β . of the salt of wormwood ζ ii. with what will suffice of the Syrrap of the rinds of Citrons, make an Electuary. The dose morning and evening the quantity of a nutmeg. After the same manner may be given to poor people Conserves of the Tree of Life, or of the leaves of Rue twice in a day.

The Liquors appropriat against the hysterical affections, and to be drunk after the aforesaid Medicines, are, either distilled waters, which are to be taken by themselves, or with other things, in form of a Julap, or decoctions, or tinctures and Infusions.

Take of the water of Mugwort, and of penny Royal, each half a pint, of hysterical water ζ iiii. of the Tincture of Castor ζ β , of the Syrrap of Coralls, ζ i β , mix them. The dose from ζ i to ζ i β , with any of the medicines afore described.

Take of the leaves of Penneroyall, of Fetherfew, of either Southernwood, of Calamint, of Nep, and of either Horehound, each i handfull; of the Roots of Bryonie ζ iiii, of the seeds of Parsnips ζ ii, cut and brused, put them into white-wine or Cider, six pints, and so distill them, according to art.

Take of the Root of the male Peony, Angelica, Valerian, each ζ β , of the leaves of mugwort, ground Pine, Calamint, Pengeroyal, and Missjetow of the Oak, each i handfull, of the Seeds of either wilde Parsneps, each ζ iii, of Raisins i. handfull; let them be boyled in 4 pints of Spring-water, to the half: add to it of white-wine, lib i β , strain it, and keep it in close vessells; The dose ζ iii, or 4 twice in a day.

Take of the wild-Parsnep Seeds brused ζ ii, of Castor ζ i, let them be put into a Glass, with i quart of white wine. The dose ζ ii twice in a day.

3. As to the third Intention, which inhibiting the disorders of the womb, doth promote the cure of the passion called hysterical; I say, first of all what in times past was believed, concerning the Cause and scope of curing the disease, that the womb did ascend, therefore that it ought to be reduced into its right place; is altogether fictitious, as we have elsewhere shown: The falling down of the womb, or its coming forth, oftentimes happens; but rarely, or never produces the hysterical Distempers: Besides, the dislocation of the womb in childbearing Women, sometimes happens, presently after their bringing forth, to wit, when the body of the womb being made Capacious, and newly emptied, doth not sink down or fall within the Tunnel, in its right place, but upwards inclines now to the right side, now to the left, and there being drawn together like a purse, is folded into a great bulk, which kinde of bulk, remaining long, nigh the side of the groin, is wont to give a suspicion of another child, or the secondine or afterbirth to be left behinde, or also of some hard swelling tumor there increasing; but afterwards, when the *menstruum* coming plentifully away, the womb is reduced to its due magnitnde, that tumor by degrees vanishes: bnt while it there remaineth unless for that reason, the *Lochia* or *menstrua* were stopp'd, it doth not produce the hysterical passions. For the reducing of this part the sooner into its due position, fomentations, Liniments, and Plaisters, are convenient. But most times that Symptom, passes over, of it self, without any further harm. To what other distempers the womb is obnoxious, in child-bearing, and by what method to be helped, we have fully shown in another place. As to the other vices of that part, which happen to some women, not bearing children, we declare, that they chiefly are either a disease of the womb, made by the breaking of the unity, viz, which is either some ulcer, or Tumor; or an inhibition of some wonted excretion, or putting forth, to wit, a suppression either of the menstruous blood, or the whites, or the seminal humour: Moreover because of the *menstrua* being retained, the heterogeneous particles being often poured forth into the head, bring in the Convulsive passions: in like manner, when the whites are stopped, the excrementitious matter, being supped up by the blood, is deliver'd to the brain and nervous stock: yea, when an usual evacuation of the seed is hindred, the superfluities of the nervous humour, flow back upon the brain, and infect its indwelling Spirits, with an explosive and morbid tincture: There is no need here, to discourse more largely or particularly, of those Peculiar distempers of the womb, but to compound medicines, and intricate administrations, proper for womens diseases, with anticonvulsive Remedies.

CHAPTER. XI.

Of the Distempers commonly called Hypochondriack, which is shown to be, for the most part Convulsive: briefly also of Chalybeats or Steel-Medicines.

IN the foregoing Chapters, we have clearly shown, that the Passions called hysterical, do not allways proceed from the womb, yea, more often from the head being distemper'd; next we shall inquire concerning the hypochondriacal Distempers, of what original and nature they are, and upon the fault of what parts they chiefly depend. The vulgar opinion is, that the symptoms wont to accompany this disease, are wholly produced from the spleen; wherefore, they are ascribed very much to vapours, arising from this inward, and variously running up and down, here and there; when in truth, these sicknesses for the most part are convulsions, and contractions, of the nervous parts: but that it might appear, by what causes they are wont to be excited, we ought to consider first, the Symptoms themselves, and to place them into some order or rank.

A description of the hypochondriacal Affections.

As to the Distempers therefore, which are vulgarly termed *hypochondriac*, it is observable, that they happen chiefly to men of a melancholly temperament, with a dark aspect, and more lean habit of body: it is rarely, that this disease troubles fair people, with a fresh Countenance, or also those indued with a too Phlegmatic complexion: It betrays it self in manifest signes, about the hight or midst of their Age; men are found to be more frequently obnoxious to this, than women, being made habitual in either, it is very hardly, or not at all to be cured, in women, by reason of their weaker Constitution, it is accompanied, with a great many more Convulsive Distempers, wherefore, Commonly it is said in this Sex, the hysterical, to be joyned with the *hypochondriacal* Passion.

The Symptoms which are imputed to this Disease, are commonly very manifold, and are of a divers nature, neither do they observe in all, the like beginning, or the same mutual dependency, among themselves: for they seem in these, most to affect the Inwards of the lower belly, in those the *Precordia*, in others the Confines of the Brain: and in most, though not in all, the ventricle labours much; concerning the appetite it is often too much, but presently burthened with what it hath taken in; and when the food, staying longer in it, by reason of slowness of Concoction, their Saline particles being carried forth into a flux, pervert the whole mass of the Chyle, into a pulse or pottage, now Sour, or austere, now salt or sharp: from hence pains of the heart, great breakings forth of blasts, rumbling of winde, and often vomiting succeed; and because of a pneumatick defect, or of Spirits, the Chyme or juice, is not wholly made volatile, and carried forth of doors, but that the ballast of the Viscous or Slimy matter, sticking to the coats of the ventricle, is left behinde; an almost continual Spitting infests them; a distention in the *hypochondrium*, and often there, and under the ventricle, a cruell pulsation is felt: also there pains ordinarily arise, which run about here and there, and for many hours miserably torment with a certain lancing: In the mean time, from the Contractures of the Membranes, and from the fluctuation of winds, stirred up by that means, rumbling and murmurs are produced: Also in the *Thorax*, oftentimes there is a great constriction and straitness, that the respiration becomes difficult and troublesome, upon any motion: also, most grievous asthmatical fits fall upon some: moreover, the sick are wont to complain of a trembling, and palpitation of the heart, with a noted oppression of the same: also a sinking down or melting away of the Spirits, and frequent fear of a trance, comes upon them, that the sick think Death is always seising them: In this Region, about the membranes, and chiefly the *mediastinum*, or that divides the middle of the belly, an accute pain, which is now Circumscrib'd to one part, now extended to the shoulders, is a familiar Symptom of this Disease. But indeed in the head, an Iliad of evils doth for the most part disturb hypochondriacal people, to wit, most cruell pains returning at set times, do arise, also the

the swimming of the head, and frequent *Vertigoes*, long watchings, a Sea, and most troublesome fluctuation of thoughts, an uncertainty of minde, a disturbed fancy, a fear and suspicion of every thing, an imaginary possession of diseases, from which they are free; also very many other distractions of Spirits, yea sometimes Melancholly, and madness accompany this sickness: besides these interior Regions of the Body besieged by this Disease, wandring pains, also Convulsions, and numbness, with a sense of pricking, invade almost all the outward parts; nightly Sweats, flushings of the Blood in the face, and the palms of the hands, eratick feavours, and many other Symptoms, of an uncertain original, do every where arise; concerning which, forasmuch as the genuine Causes, and the manner of their coming to pass, could not be readily determined, presently all the fault is cast upon the Spleen, and Physicians accuse that, as if it were the chief author of every irregular Distemper; but by what right or authority, by and by shall be sought into: In the mean time, it is to be observed, that the chief Symptoms of this sickness, are Convulsive, and depend immediately upon the irregularities of the animal Spirits, and the nervous juice, rather than on the evil disposition of the *Viscera*, serving for Concoction. But indeed, from whence the first rise of this most complicated Disease proceeds, and by what means it brings forth the divers manners of distempers, in so many places, will not be so easie to determine.

The hypochondriacal distempers belong to the nervous kind.

It would be a tedious thing, to shew here, what the ancient and modern Physicians thought of the *hypochondriack* Passion, and of its essence, and Causes; we will only take notice, that most of them do ascribe this sickly Disposition, to the only fault of the Spleen; In the mean time some contend that the whole confines of this Inward, partaking of part of the fault, the blood flowing every where in the Splenetick, and Epigastric Vessels (or those belonging to the Spleen and belly) for that it being guilty of an hot and dry intemperature, and so obnoxious to too much fermentation, brings forth the original, or gives a beginning to this manifold evil: But the famous *Highmore*, affording relief, as well to the Spleen, as the Womb, hath cast the chief Cause of this Disease, wholly on the vitious Constitution of the ventricle; and from thence, he would have the reasons of the aforesaid Symptoms, to be originally sought, But indeed, that he might frame a fit *hypothesis*, for the solving the *Phenomena* of this sickness, he first supposes, the tone of the stomach to become too loose, and weak, that for that reason, it hardly, and very imperfectly Concocts the aliments: so that the thin, and more Spirituous part of the Chyle, being sent from thence, sooner than it ought, to the blood, perverts its disposition, to a hot and sour temper; then the residue of the food, by a longer stay, within the Ventricle, degenerates into a ponderous, and viscous or clammy Phlegme; which also, by its Stagnation (even as it is observable in things to be eaten, being longer kept) becomes very sour, or sharp: But from hence, that learned Man argues, that from the blood made too ferous and thin, its effervescencies quickly passing thorow it, are induced: and from the stomach, loaded with ballast of ropy or viscous matter, the winde and distentions of the Ventricle, and *hypochondria*, as also the belching, and troublesome Spitting, do arise: whereby indeed, he wholly exempts the Spleen, from this fault, he contends, that it doth neither draw to it self the melancholly dregs of the blood, nor serves for any office whatsoever, about the Sanguification or the making of blood; but that its use almost only consists in this, that this Inward swelling up, or growing turgid with very hot blood, it administers heat to the adjacent Ventricle, and cherishes it with gentle warmth.

Altho I may so far assent to this famous Author, concerning this opinion, that I yield, the ventricle doth often grievously labour in this Distemper, forasmuch as the tone of which, being made lax, and its strength broken, by reason of the indigestion of the aliment, a load of viscous Phlegm, or Petuitous matter, is begotten even in its bosom, to which, by reason of the Saline particles, being brought into a flux, by their long stay, oftentimes a notable soariness, and austereness happen; then because the fault in the first Concoction is not mended, the dyscrasies and disorders of the blood, receive that want of digestion in the second: But yet he cannot draw me into that opinion, that the ventricle is always chiefly in the fault, or that the other Symptoms, of the

The Hypothesis of Dr. Highmore is sifted.

pochondriacal Disease, depend only on its vitious Constitution: For I have known many, cruelly afflicted with this sickness, who have been well enough in their stomach: although they have very much complained of the pulsation in the left hypochondrium, of the straitness of the breast, and a wandering pain excited in it, also of the trembling, and oppression of the heart, with a continual fear, and disturbed Imagination; in the mean time, they were wont to desire food greatly, and to digest whatsoever was eaten, without any trouble of the ventricle, or heaviness, and also without any spitting or acid belching: yea, I have observed others, great drinkers, and using an evill manner of living, to have contracted a looseness of the stomach, with an ill digestion, windiness, and frequent vomiting, who sound enough about their *precordia*, and animal faculties, were not at all accounted for *hypochondriacs*: Besides, in this Distemper, the ventricle is often rather sick from the vitiousness of other parts, or of the Blood, than from its own default; because, it is usual for those sort of sick people, to be well in their stomach, so long as they may lye abed, and breath it forth; but when they are raised up, the pores being shut up, and the dregginess of the bloody mass stagnating within, presently to be afflicted with the pain of the heart, an aggestion of winde, and frequent endeavours to vomit.

For these, and other Considerable Reasons, I judge the original of the *hypochondriacal* Disease, to be derived from some other fountain, than the weakness of the Ventricle: but forasmuch, as among the parts here primarily suspected, to be affected, great complaints are made against the Spleen; it will be worth our while, to enquire, what office this Inward doth discharge, then, as often as it fails in it, whether it contributes to this Disease.

The use of the
Spleen is in-
quired into.

Tho I may grant with Doctor *Highmore*, that the Spleen doth cherish the Ventricle with its warmth, and so perhaps in some measure help Concoction: yet I do not conclude, this part to be framed chiefly for that end, but for some more noble uses; because, there seems to be need, for the digesting of the food in the stomach, not so much of heat, as of an active ferment: For fishes being actually cold, devour their food whole, and without the help of heat, easily concoct the same, being resolved as it were by a certain *menstrum*: besides, it is observed of the spleen, that though in man, its whole substance lyes near to the ventricle, in most other creatures, who are indued with a longish form, as to the greatest part of it, it is removed far from the Ventricle: Further, if the Spleen be the only Chimney, in which the blood warming the Ventricle is contained, what is the reason, that it, rather than the Liver or Lungs, becomes of a livid or blewish colour, and is stuffed with a black blood, and that less hot?

See his dis-
course of fer-
mentation.
Chap. 5th

When I consider these things, which sometime since I have observed; concerning the use of the Spleen; it seems far more probable, that a certain dreggy portion, *viz.* a matter, consisting of an earthly, and fixed salt, is layd up in this Inward, by the blood carried to it, by the arteries, which being exalted there as it were by digestion, and into the nature of a ferment, is lastly committed to the blood, flowing from it by the veins, which inspires or quickens it, with a certain leven or fermentation, and performs the same thing about its Spirit, or making it Spirituous, as our ferment commonly called Leven, doth, being put into a batch of bread or dough; for as a certain portion of the unbak'd bread or dough, being kept to a sourness, preserves the same nature, that it doth ferment or leaven other bread or dough, and stirs up in it the otherwise sluggish particles into motion; so it seems, that the blood being laid up in the milt or Spleen, and there getting a sourness, as it were by stagnation, puts on the nature of a ferment, whereby indeed the rest of the mass of blood, and perhaps the other humours, are actuated, and as it were Spiritualised, into a more lively motion. What hath been ingeniously wrote, by a late author, *viz.* the most learned *Velthufius*, concerning the use of the Spleen, may have relation to this: for he hath determined as highly probable, a ferment to be contained in this Inward, whereby the sluggish particles of the blood, are brought into a state of activity: Because, taking notice, that in children, and others indued with a sanguine temperament, and more fat or dull habit of body, even as their manners, and disposition of minde were inclined to idleness, softness, and dulness, so their Spleen was ever of a reddish colour, and full of florid blood, like the Liver: from hence he concludes, that the spleen doth but little perform its of-
fice

fice in these, as the genital parts before ripe age, or in those of weak loyns; but on the contrary, forasmuch as men of a middle age, and chiefly in those, who are of a severe Countenance, and of a lean body, as in them appear marks of cunning, Sagacity, fortitude, and constancy, so their spleen is found to be of a livid or blewish colour, and imbued with blood, as it were muddy: further he argues from hence, that the blood, being kept long in the spleen, as in a Conduit or receptacle, turns plainly into ferment, by which its remaining mass, being from thence inspired, is made more subtil, and begets more acute Spirits; both in the vital, and in the Animal Kingdom or Government: For he supposes, our bodies naturally to abound, with too much humidity, by which indeed the function of the parts, and many of the *viscera*, are very much dull'd: but that the spleen, doth communicate to the mass of blood, solid, firm, and constant parts, and not easily to be dissipated; and that those do wipe away that moistness, and with it carry away in some measure, that softness, from the blood and Spirits, which is predominate in tender age: almost after the same manner, as the north-winde, or the eastern gales, fanning and intimately penetrating the air, with the dryness and strength of their parts, breathe health or strength to the air, and to our Bodies.

But since I have in another place, declared what I have formerly thought, concerning the Spleen, there will be no need to repeat it in this: yet I shall further note, that in bodies of living creatures, compacted out of a quinarie of elements, as the spirits ought to be more strong then the rest: so indeed they being intangled with a viscous humidity of Sulphur, and water, are so hindred, that oftentimes they are not able to exercise their strength or powers lively enough; hence saline particles, for that they are very much fermenting, are required for this, that the spirituous little bodies, almost overwhelmed by the embrace of the others, and stupified, might lie awakened, and set at liberty, and into motion. Wherefore we experience in our selves, when the spirits are dull'd, by the blood being too much exhal'd, that notable help is brought, by sharp liquors, as chiefly small wines, and Cider: for these kinde of Remedies sharpen the Spirits, and shake off all heaviness. Such a kinde of fermenting virtue, we easily believe to be continually exercised, by the Spleen being in right order, towards the blood and nervous Liquor.

For as this inward is formed with a threefold sort of vessels, *viz.* with arteries, and veins, and besides with great enfoldings of the nerves, and a most thick Contexture of nervous *fibres*; we think the use of each of them, to be set apart for this end: to wit, by the Arteries, the blood is carried to the Spleen, hence it lays up its dreggs, composed of a fixed Salt, and an earthly matter, in its passages and porosities, and these there layd up, as it were by a certain digestion, are brought into a juice very fermentive: A portion also of which, being carried back to the blood, by the veins, is continually mixed with it: and so its whole mass, is inspired with those kinde of fermentive particles, from the Spleen; by which, a certain austerity and sharpness, with vigour of motion, is given unto it; so that, for that reason, the blood it self is carried more lively in the vessels; also from thence, the nervous juice, procreated from the blood, being more active supplies the animal regiment: But truly, the Spleen doth not only by this means mediately, and by the intervention of the blood, inspire the brain and nervous stock, with a fermentive virtue; but it may be lawfully believed, that this is done somewhat more immediately, by the passage of the nerves, dispersed in the spleen: for, because in this part, anatomie discovers a great company of Nerves, and nervous enfoldings, and of *fibres* springing from them, it may well be doubted, for what use they should serve: Concerning this, it is first to be observ'd, that the ventricle, and the Spleen, have a most intimate Commerce with the brain; insomuch, that *Helmont* did place the seat of the Soul, in those Inwards, but this is possible to be done, by no more commodious way, than by the aforesaid nerves: Wherefore, we may here deservedly suspect, that not only the animal Spirits, are the messengers between the one part, and the other, but also, that the nervous Liquour, which is both the food, and the ventricle of these spirits, doth descend now from the brain towards these Inwards, and now being received from these *Viscera's* by the nerves, doth creep thorow towards the head: which kinde of spleeny Juice, being dilated

ted to the brain, sharpens the animal Spirits, and raises them up being slothfull, and irritates them into quick motions: from whence it is commonly said, the sharpness and sagacity of the minde, doth proceed from the Spleen, and Splenetick peop'le, are accounted Ingenious: But it is probable, that the rage, and force of the passions, being begun by the Spirits inhabiting the brain, are carried to the spleen, by the passage of the nerves; and so the spirits there dwelling, are pathetically troubled, and the blood flowing thither, is moved into a multitude of perturbations: for from hence it in some measure falls out, that in anger, sadness, and other distempers of the minde, according as the ferment of the Spleen, being more or less moved, is inspired to the blood, its liquor diversly boyls up: Further, for this reason it happens, that great inflations and Commotions, of the left *hypocondrium*, come upon splenitic people, from every violent passion.

The reasons of the hypochondriacal Symptoms laid open.

These things being thus premised, concerning the use of the spleen, it will be easie, according to our *hypothesis*, to lay open very many of the symptoms, belonging to the *hypochondriac* Distemper; and to give reasons for each of them: For when the Spleen is wanting in its office, that is, when it doth not strain forth the melancholly recrements of the blood, nor cook them into a fermentative matter, as we but now observed in children, and others of a sanguine Complexion, or too phlegmatick, to happen often; the disposition of the minde, is made duller, the body grows fat with idleness, yea, and the blood being more sluggish than it ought to be, is apt to stand still within its vessells, or at least to be less lively circulated: But on the Contrary where the fermenting power of the spleen, is too much exalted or perverted, the blood by that means being more sharp than usual, or made more sour, it runs about rapidly here and there, and conceives irregular motions; yea, and the nervous juice, falling away from its right temper, imbues the animal Spirits, with an heterogenous and an explosive *Copula*, and so irritates them, as it were with goads, into frequent Convulsions: as that not wholly undeservedly, many kindes of diseases, may be imputed to the Spleen being out of order: But the ways or means of affecting, whereby the Spleen being evilly disposed, doth produce the symptoms of the hypochondriack passion, or at least contributes to the rise of them, are chiefly these following.

The Influences of the Spleen in producing the symptoms unfolded.

First, it sometimes happens, that the spongie substance of the spleen, from the faces of the blood, being too much impacted, in its pores, and stagnating, is very much stuffed, and obstructed: that from thence, it doth not sufficiently receive, the recrements of the bloody mass: but the same being carried thither, but not received do flow back into the neighbouring branches of the *Cæliack* Artery, from whence they are presently carried, into the membranes of the ventricle, the Caule, the mesenterie, and other nigh parts, and are wont to be affixed to them; hence the tone of those *viscera*, are so much spoyled, that they do not rightly perform their due offices, about the concoction of the Chyle, and the membranes planted every way about, being much imbued with heterogeneous and irritative particles, for that they are almost continually pulled by convulsions here and there stirred up, they are grievously obnoxious to wandering pains, contractions, distentions, and the encrease of Windes; by reason of this kinde of regurgitation of the blood, from the Spleen, being obstructed, it is likely, that the pulsation, which is felt by hypochondriacks, under the Ventricle, is excited.

2. When the feculencies of the blood, are excluded from the Spleen being obstructed; being fixed (as was said) to its neighbouring parts, they bring forth the sickly distemper of the left *hypocondrium*: but though indeed, that Inward sufficiently receives the melancholly or atrabilious juice, carried to it from the blood, by the Arteries, yet oftentimes it does not rightly Cook it, but the Salt being too much excited, it changes it into a too sharp, or acid, austere, or sour; or some other kinde of vitious humour: whereby, when as the whole mass of blood, and the nourishable Juice, contained in its bosome, are almost wholly infected, the fruits of the hypochondriack seeds, bud forth thorow the whole body; the blood grows unduely hot, is in some places impetuously moved, and again in others is apt to stagnate or stand still: from hence, it is familiar with Splenetick people, presently after eating, to grow red in the face, to have the palms of their hands hot, their hypochondria to swell, oppressions of the heart, and noted variations of the pulse, to succeed, But these fermentative particles being translated, from the blood, every where into the solid parts, wandering pains, running

ing up and down here and there, and a sense of pricking, are stirred up in many members of the Body: moreover, from this Infection of the blood, for that its mass is changed, from a benign and balsamick temper, into a salt and tartareous, a lean habit of body, with a black and dark Countenance, is induced.

3. From the blood being so depraved, by the fault of the Spleen, oftentimes the taint is carried to the animal government; for heterogeneous and Convulsive Particles, are poured frequently into the brain, and from thence, into the nervous stock; so that the animal Spirits, dwelling in either province, conceive various irregularities: by reason of the evil being impressed on the head, hypochondriacks use to be troubled with various phantasms, with an heap, and fluctuations of thoughts: besides, to them happen frequent *Vertigoes*, Scotomies, headaches, and often paralytical Distempers: then, forasmuch as the morbid matter, slides down from the head, into the nervous stock, Convulsive Diseases are excited, in very many parts of the body, but chiefly about the *Præcordia*, and *Viscera* of the lower belly: for when the Spirits flowing within the nerves, which respect those parts, are greatly disturb'd, by reason of the distemper of the minde, the Convulsive particles, the more readily enter into those pipes, and more easily impress on those Spirits, a Convulsive Disposition: Therefore, partly by reason of the infection mediately transmitted to the Brain, and partly by reason of the hurt, (as hath been shown) immediately Communicated from the Spleen, the Palpitation of the heart, trembling, and frequent swooning, Constrictions of the Breast, impediments of breathing, Pains of the stomach, belching, Vomiting, and many other accidents in those Inwards, happen to hypochondriacks.

4. Besides these inordinations, which are wont to be derived by the passage of the blood, from the Spleen; into the humours and solid parts, and to the brain it self, and nervous stock; there are other farther evils, which seem to arise from this Inward, also by the passage of the nerves: Because, as we have shown, their extreme branches, and the nervous *fibræ* themselves, interwoven in the *Viscera*, do drink in with their outward most little mouths, a certain humor, and convey it sometimes upwards, it is highly probable, that the nervous *fibræ*, distributed to the Spleen, (of which as we but now hinted, there is a mighty Guard) do receive its most sharp juice, which Creeping higher, thorow the nervous pipes, becomes a Cause of Convulsive motions: In truth, that there may be those intimate Commerces, between the brain, and the Spleen, to wit, far sooner, than what can be made, by the compassing about of the blood, it may be lawfull to believe, that the nerves of the wandring pair, and the intercostal, to be the neereſt means of the passage, whereby these parts Communicate one with the other, and mutually affect themselves. For it seems, that when the black bile or melanchollic tumor in the Spleen, grows turgid or swells up of its own accord, or is moved by some evident cause, its particles enter the nervous *fibræ*, thickly distributed to the same, which disturb the animal Spirits flowing in them, into explosions, or at least into some disorder: then the Spirits being so disturbed, infect those next to them, and they others, till by their continued series, the passion begun within the Spleen, is propagated even to the brain, and there produces inordinate Phantasms, such as happen to hypochondriacks, also on the other side, when a grievous distemper of the minde, occasionally excited, within the brain, doth disturb the Spirits inhabiting it, the impression being carried to the Phantasie, by the series of the Spirits, planted within the nerves of the wandring pair, and the Intercostals, and successive affection, it is brought even to the Spleen; hence its ferment being put more into commotion, stirs up Convulsions, both in that Inward, and in the whole neighbourhood of fibres and membranes; and besides, forces the blood into ebblings and flowings, and into various æstuations or vehement motions; yea and reflects the perturbations of the Spirits, upon the brain. From this kinde of reciprocal affection of the brain and Spleen, it comes to pass, that hypochondriacks are so unquiet, unstable, and fluctuating, at every thing thats proposed, as if, according to the Poet, Ten mindes strove in them at once.

A certain noble Gentleman, of a melanchollic temper, and always accounted *Observationi* for a Splenetic man, very much complained of a pain, and inflation of his left hypochondrium, with a frequent rumbling noyse, and sour belching, also of a trembling

trembling of the heart, of an assiduous vertigo, too much waking, and a disturbed phantasie: About the 35th. year of his age, the disease growing worse, he began hardly to sleep, and yet more rarely to get it at night, and to be molested in the day time, with a world of fluctuating thoughts, to have in suspicion all things and persons, and greatly to be afraid of every object: his *Præcordia* seemed to be very much bound, and straitened, and to sink down to the bottom, as if the heart it self were depressed even into the belly; which Symptom, troubling him, he became very sad, and dejected in minde: yet afterwards, those distempers of the minde remitting, he felt with it his heart to be a little lifted up and also his *Præcordia* to be loosened, and stretch'd forth; besides, he very often sustained pains and Contractions variously excited, about the muscles of the *Viscera*, and Members, and running up and down here and there.

As to the nature of the disease, it is plain, that it is this kinde of Distemper, which is commonly called hypochondriacall: but as to what respects the Causes of these to be admired Symptoms, we may suppose, the mass of blood being degenerate, and stuffed with melanchollic or atrabilarie faculencies, to administer or continually to suggest its adust recrements to the head; from whence, the Liquor watering the brain and nerves, being made sharp, and improportionate to the Spirits, did stir up the containing Bodies, into painfull Corrugations, or wrinklins, and Contractions: Further, when this Infection is chiefly derived from the head, into the Nerves of the wandering pair, and the intercostall, the brain and the *Præcordia*, are very much punished, by the malady from thence raised up. But that the Blood is depraved by that means, it seems to be imputed to the vice of the Spleen, forasmuch as this Inward, being amiss, it did not rightly strain forth the atrabilarie dreggs from the blood, but rather did more pervert whatsoever recrements it received from it, and the same being exalted into an hurtfull ferment, sent it back to the blood, and so very much infected its mass, and imbued it with a plainly acetous, and vitriolick evill Disposition.

It is plain to be understood, that those symptoms troubling the Head, viz. too much waking; the *vertigo*, a disturbed phantasie, with many others; did proceed from the heterogeneous particles poured forth from the Blood, into the brain: As to that straitness of the Breast, and falling down of the heart, with great fear and sadness, it may be thought, that the nervous fibres, inserted to the heart, and chiefly to the *Pericordium*, being moved into Convulsions, and wrinklins, do binde hard those parts, and pull them downwards; wherefore, there is perceived in the whole breast, as it were a certain constriction, and the heart it self seems to be depressed: Further, forasmuch the *Præcordia* being so streitened and depressed, the blood within the bosom of the heart is stop'd, and compell'd, as it were to stagnate, both the vital and the sensitive Soul, is much hindered, from its wonted expansion and irradiation, and for that Cause, being lessened and shortened in its constitution, those Cruell distempers of fear and sadness arise, but when the Convulsions remitting, that constriction of the heart and its *appendix*, is released, the Soul also, as a flame more expanded or enlarged, endeavours by little and little to shake off the Chains of those Passions. For the Cure of these Distempers, he had for a long time tried very many remedies, and medical Administrations, but without much benefit, at last he was somewhat eased by the use of Spaw-waters, and from thence by degrees finding himself better he became free from those grievous Symptoms, however, he still liv'd obnoxious to the *hypochondriac* Distemper.

2. Observation.

A Certain young Academic, originally of a Sanguine temper, fair, of a flourishing Countenance, excellent disposition, and mild, by reason of immoderate and untimely Studies, in the mean time exercise, and good order of dyet being wholly neglected, had contracted an obstruction of the Spleen, or some other morbid distemper of that Inward: For he had almost continually infesting him, an inflation, and tumor of the left *hypochondrium*, with a most heavy Pain. After he had laboured with this sort of Distemper, about half a year, he began to complain of a frequent giddiness, a blindness of his eyes, an inquietness of his minde, and of disturbed sleeps: Which Symptoms were then plainly imputed to vapours arising from the Spleen: but after that followed, a trembling of the heart, with a frequent *deliquium* of the Spirits, a pulsation of the *hypochondrium*, and at length pains, and Contractions in the outward members, with a frequent

quent stupor, and a sense of pricking running up and down here and there: and last of all, being broken with a world of evils, contrary to his *genius*, and native Disposition, he became greatly hypochondriacal.

That I may dispatch the Pathologie of this Case in a word, it appears here plain enough, that the Spleen was first of all in fault; by whose fault, when the bloody mass was depraved, the taint creeping from thence, into the humour watering the brain and nervous stock, and infecting it, did induce the aforesaid Convulsive Symptoms.

The Curatory Method to be used against the hypochondriacal Distempers requires chiefly these four generall Indications. *viz.* In the first place, that the Impediments of the Cure may be taken away, the Intention of which chiefly respects the purging, and preserving the first passages. Secondly, it must be endeavour'd that the obstructions of the Spleen, may be Corrected. Thirdly, that both the recrements of the bloody mass may be purged forth, and that its due disposition may be restored. Fourthly, and lastly, that the enormities of the brain and nervous stock, and also of the watering humour, and the inhabiting Spirits, contracted by the fault of the blood, and Spleen, may be amended, or taken away: when any of these Intentions, or all of them together, shall be endeavoured at, fit times should be chosen, in which each being singly proposed, may be performed, without any neglect or hindrance of the rest.

8. As to the first Indication, when a great load of crude or adust matter, is wont to be laid up in the first passages, and when the tone of the Ventricle us'd to be spoyle'd, and its ferment variously perverted, against every one of these kindes of evils, you must bring timely help, with fit remedies; therefore, gentle and moderate evacuations, both by Vomit if it prospers well, and by Stool, ought to be administred: For such, whose stomach easily casts forth its contents upwards, I perswade, that once in a month Vomiting should be several times provoked by taking *Liquor of Squills*, or *Salt of Vitriol*, or by drinking plentifully small beer posset-drink, or warm water; in the time between, a gentle purge, and only a little moving is to be orderd often: For this end, The pills *Tartareous*, of *Bontius*, or Stomach-pills with Gums, or our solutive extract, may be of use. Take of the best *Senna* $\mathfrak{z}\text{i}$, of *Rhubarb* $\mathfrak{z}\text{vi}$, of *Epithim* $\mathfrak{z}\text{iii}$, of *yellow-Sanders* $\mathfrak{z}\text{ii}$, of the *Salt of wormwood* $\mathfrak{z}\text{ii}$, of *Celtic Spike* $\mathfrak{z}\text{i}$, being cut and brused, let them be digested in x ounces of *White wine*, and as much of fumitory water, for 48 hours, let the clear straining be evaporated, with the heat of a gentle bath, to the consistency of an extract, adding towards the end, of the powders of *Senna*, of *Rhubarb*, and *cream of Tartar* each $\mathfrak{z}\text{ii}$, let them be brused together in a glass mortar, and reduced to the consistency of Pills. The Dose $\mathfrak{z}\text{ss}$, $\mathfrak{z}\text{ii}$, or $\mathfrak{z}\text{i}$, the Remedies respecting the tone, and ferment of the ventricle, as they are manifold and divers, out of them the most fit or commodious for the Disposition of the Ventricle, are to be chosen; for to this bitter things, to that Salty, to another sharp and perhaps biting things, are desirable. Among the number of these kindes of medicines, (which are commonly called Digestives) are *Elixir Proprietatis*, *Tinctura Sacra*, powder of *Aron Compound*, *Salt of Wormwood*, *Cream of Tartar*, *Tartar vitriolat*,, *Vitriol of Steel*, with many others. Besides these inward Remedies, also external applications do often bring help: Because the Stomach being ill affected, a fomentation of *white-wine*, with *wormwood*, *century*, and other bitter plants boyled therein, also oyntments, or plaisters, often bring help: Concerning which, there will be no need here to discourse particularly; and to prescribe forms of the Medicines themselves.

2. The second Indication, for the mending the vices of the Spleen, (to wit, if there shall be in the same any obstruction, Tumour, or pain, or simple dyscrasie or Intemperament,) is wont to be performed, or at least attempted, by Remedies both internal, and exrernal: Those which are of the former Sort, fall in with those indicated in the 3d place, (to wit, with such, as for the purifying the Blood is intended) because, when chiefly, or almost all, that which is carried, or born to the Spleen, is done by the passage of the blood, the irregularities of the *Latex* of this, as well as of that Inward, by a Social labour, ought to be cured, with the joynt strength of Medicines; by what means is shown by and by. In the mean time, some external Applications, under the form of a plaister, or an oytment, or a fomentation, more neerly and immediatly respect the body

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ac Distempers.*

a

dy of the Spleen, and often bring notable help, forasmuch as they discusse tumors, and allay the Convulsive Distempers, and quiet them. Great plenty of these kinde of outward medicines, are every where extant among Authors, the choyce of which ought to be made, according to the various passions of the Spleen, or the divers Constitutions of the Patient, so that there will be no need here, to shew their particular forms.

3. The Remedies indicated in the 3d place, to wit, which take away the dyscrasies or evill temper of the blood, contracted from the vice of the Spleen, and also clear the primary fault of the Spleen, are of a manifold, and divers kinde, and manner, the choice of which ought to be administred, according to the various infection of this, or that : of these, some are compounded, and prepared according to the prescription of Physitians, as *Electuaries*, *Powders*, *Apozems*, *Tinctures*, *Infusions*, and the like ; others more simple, as *whey*, *asses milk*, *Spawwaters*, and *Bathes*.

There are two chief Cases of sick people, in which magisterial Remedies ought to be all accommodated, according to their strength and quallities : to wit, either the blood is thick, coldish, and earthy, with the Spleen being obstructed, which requires more hot, fermenting, and chiefly Chalybate medicines ; or the blood being clearly adust, and hot, ferments too much, and together greatly troubles the *hypochondria*, and in them, the blood and humours boyl up ; in which state, Remedies only temperate, and allaying the fermenting, and immoderate boylings of the humours, are to be chosen, where chalibiate are wholly to be avoided.

When therefore to a cold ventricle, cold discrasies or evill temperaments, of the blood and Spleen also happen, I am wont to prescribe, according to the following forms.

Take of the *Troches of Rhubarb*, of the *Powder of the root of Aron*, of *winteran Bark*, each $\mathfrak{z}\text{ii}$, of the *root of virginian Snakeweed*, *Centrayerva*, *Diatrion Santulon*, of *Crabs eyes*, each $\mathfrak{z}\text{i}$, of the *extract of Gentian*, of *Century*, each $\mathfrak{z}\text{is}$, of *ammoniae*, dissolved in the water of *Earth worms*, what will suffice to make a mass of Pills : let them take 4 pills in the morning, and at 4 a clock in the afternoon, drinking after them a little draught, of *wormwood-wine*, or *chalibiate wine*, with moderate exercise.

Take of the *Conserves of the yellow of Oranges*, and of *Lemons*, each $\mathfrak{z}\text{iii}$, of preserved *mirabolans*, n. ii , of the *Species of aromaticum Rosatum*, of *winteran Bark*, each $\mathfrak{z}\text{ii}$, of the *Salt of wormwood* $\mathfrak{z}\text{ii}$, of the *vitriol of Steel* $\mathfrak{z}\text{i}$, (or *Steel prepared* $\mathfrak{z}\text{iii}$.) with what will suffice of the *Syrrop of Citron rines*, make an *Electuary*, To be taken twice a day, drinking after it a draught of *wormwood-wine*, or of the *Infusion of the herb or flowers of Tamarisk*.

For those who are not pleas'd, but with medicines in an elegant form, and in a very little quantity, the tinctures of *Antimony*, and of *Corrall*, also of *Steel*, with the *Spirit of wine*, (the body being first dissolved by a proper *menstrum*, and reduced to a *Calx*) are convenient : as also the *Spirits of Sut*, of *blood*, or of *harts-horn*, to be taken twice a day, with a proper liquor, to 12. drops, more or less, are of known benefit, above any other medicine that I know of : moreover the often drinking of *Coffee*, also that made of the *Infusion of the leaves of Thea*, gives ease to some.

If that the fervor of the blood, and too fermenting, with the trouble of the Spleen, and unquietness of the minde, be joyned to the hypochondriac Distemper.

Take of the *Conserves of hyssop* or *Conaradine*, $\mathfrak{z}\text{vi}$. (or of the flowers of *Tamarisk*, and the leaves of *wood-Sorrel*, each $\mathfrak{z}\text{iii}$.) of the *Species of Diarrhodon Abbatis*, of the confection of *Alkermis*, each $\mathfrak{z}\text{i}$, of the *powder of Ivory* $\mathfrak{z}\text{is}$, of *Pearls* $\mathfrak{z}\text{ss}$. of the *Salt of Tamarisk*, and *wormwood*, each $\mathfrak{z}\text{i}$. with what will suffice of the *Syrrop of green Citrons*, or *Clove-Gilliflowers*, make an *Opiate*, to be taken twice in a day, the quantity of a nutmeg.

Take of the *pcwder of Ivory*, $\mathfrak{z}\text{ii}$. of the *Powder of Pearls*, $\mathfrak{z}\text{i}$. of the *Species of diarrhodon Abbatis*, of *Diamagarit frigida*, each $\mathfrak{z}\text{is}$. make a fine powder, add of *white Sugar*, dissolved in *Baume-water*, and boyled to the consistency of *Tablets* $\mathfrak{z}\text{vi}$. make thereof according to Art, *Lozenges*, or little cakes : take $\mathfrak{z}\text{is}$ or $\mathfrak{z}\text{ii}$ twice a day. To these, and other medicines of this nature, may be joyned the

use

use of Spaw-waters, which indeed, in either, yea, in all cases, of hypochondriac Melancholly, are almost always taken with good success: For want of those waters, our artificiall Spaw-waters, may be conveniently ordered, yea, and whey, and if any notable atrophie be, let Asses milk be dayly taken.

Besides, these inward Remedies, and other outward Applications, before-recited, *Phlebotomie*, or the taking away of blood with Leeches, from the sedal veines, may be of use frequently: yea, sometimes it may be convenient, to open the Salvatella Vein, according to the prescript of the Ancients: Besides Cauteries, or Issues, which may continually carry forth the adust recrements of the blood, and by degrees excern them, are wont to be beneficiall almost to all.

4. The fourth Indication, respecting the affections of the brain, and nervous stock, or the Convulsive Symptoms having relation to or coming upon the former, is rarely in use of it self, and apart from the others, but that Remedies destinated to this end, are complicated with those abovesaid. Liquors indued with a volatile Salt, or an armoniac, as *Spirits of Harts-horn*, and *Sut*, are highly necessary for this Intention, as also the rest but now recited; wherefore such Remedies, unless any thing shall shew the contrary, may be dayly given at fit hours. Further, when Spaw-waters are drunk, let tablets or pills, such as are above-prescribed, for the Convulsive distempers, be taken at least twice in a day. In the frequent turning, and giddiness, also in the passions of the heart, the sinking down of the Spirits, with dread, and as it were a fear of Death, just seizing on one, I have known very often, great help to be had, by the use of Chalibeat, or steel Medicines.

Since we have made mention so often, of Chalibiât or steel-medicins, it will be worth our while, to inquire into their various preparations, and for that reason their divers manners of effects, which they are wont to produce in the humane body, that it may from hence appear, by what means, and for what respects, these or those preparations of Iron, are greatly profitable to some hypochondriacks, and to others as much hurtfull.

The preparations and effects of Steel Medicines unfolded.

The virtue and operation of Chalybeat, or steel'd medicines, depends upon the porticles of the concerts, being after a various manner dissolved, unfolded, and brought forth into act: For steel, or Iron, consists chiefly of a *Salt Sulphur*, and *Earth*: and but slenderly indued with Spirits and water: But the particles of the former Elements, chiefly the Sulphureous, and saline, being in their mixture combined together, with the Earth, remain altogether fixed, and sluggish, but being soluted, and pulled one from another, they come to be of a very efficacious Energy.

The aforesaid particles are dissolved in a twofold manner, and set into the Liberty of acting: *viz.* either by Art, whilst medicins are prepared, or by Nature after they are taken inwardly; for the metallic Body, is wont to be dissolved; and eaten, by the ferment of the ventricle, just like a Chymical *menstrum*: we will consider the several *Species* of either, and their manner of being made, that it may appear, what alteration is impressed, on the steeled medicine, in the preparation; and what effects every preparation of it, doth impresse on mans Body.

The most simple way of preparing Iron, is a division of its body, into little integral parts, with a file, which resemble the nature of the whole mixture, and contain both little sulphureous bodies, and saline, combined among themselves; and with other terrestrial. The filings of Iron being inwardly taken, is dissolved by the ferment of the ventricle, as it were by an acid *menstrum*; the signes of which are, both a sulphureous and unsavorie belching, as from the eating of hard eggs, also the blackness of the ordure, from steel being dissolved within the *Viscera* of Concoction, active particles, both Sulphureous and Saline, plentifully sally forth, and being involved with the nutritious juice, are carried into the blood; which as they excell in a divers virtue, do often conspire, as it were with the joynt forces of either, to bring benefit to the sick. The Sulphureous little bodies being brought to the blood, add to it a new, and more plentiful Provision of Sulphur, wherefore its mass, if before it was poor and liveless, doth nimbly ferment within its vessells, and being inkindled farther in the heart, acquires a more intense heat, yea, and a deeper colour; for it is so observed, in many affected with the dropsy, arising from white phlegm, the Pica or evill

longings;

longings, or green-sickness, to have a pale countenance, cold blood, and waterish; but by the use of steel, the countenance soon to be more florid, and the blood to be imbued with a more intense tincture, and heat: moreover, from the filing of Iron, dissolved in the ventricle, also Saline particles are brought forth; and often they bestow a more plentiful fruit or increase, both on the solid parts, and on the humors; for since their natures are vitriolick, and stiptic or binding, they bind together, and strengthen the too lax, and weakened *fibres* of the *Viscera*, and so restore the broken tone: Besides these Saline particles, inhibit the force of the blood; repress it from too much heat, and boiling up, and froth, and retain it in an equal circulation: Besides (which is their chief virtue) they contract and straiten the too loose, open, and gaping little mouths of the Arteries; that, for that reason, neither the *Serum*, nor the bloody *latex*, may sweat out, or be broke off, from the file of its circuit: Wherefore in the Dropsie, and great bleedings, Remedies, imbued with the Saline particles of Iron, are of famous and efficacious use, for very many Diseases proceed from this cause, forasmuch as the little mouths of the Arteries, being too open, and the interspaces of the vessels above measure loosened, the *serum* or bloody *latex* breaks forth; which kinde of Affections, the Vitriollic Particles of Steel, do often help, by binding and corroborating, the sanguiferous Vessels, and nervous *fibres*.

After this manner, the *filings of Steel*, being taken inwardly, seems at once to add to the blood, both spurs, and a bridle. But forasmuch, as from this medicine, an incitation, much more than a restriction, doth arise, therefore it ought to be given only to them, whose blood is very thick, and cold, as country people and strong persons; in very hot, and spirituous blood, and in hot inwards, 'tis no ways convenient: moreover, in delicate persons, and men of a more tender constitution, 'tis dangerous, lest the little portions of the steel, when they cannot be sufficiently dissolved, should like fragments of glass, be driven into the membranes of the *Viscera*, and there pertinaciously sticking, produce some ulcer, or deadly torments, which indeed I have known sometimes to happen.

2. After the filing of Iron, the next way of preparing it, is calcining it with Sulphur, to wit, let thin peeces of steel, being strongly fired, be laid upon a roler of *Sulphur*, that the mettle may melt into little round balls, which are to be calcined to the consumption of the Sulphur, and pounded in a mortar, are to be reduced into a subtle powder, which is of choice use. In this preparation of Iron, some sulphureous particles are exhaled, the signe of which is, that this powder, an acid liquor being poured upon it, much less boyls up, or grows hot than the limature or filing of Iron: but being taken by the same mouth, it excites a Sulphureous savour. In the mean time, in this preparation, the saline particles, seem to be somewhat augmented, by new ones sticking to them, from the mettall burning with Sulphur, so that active particles of either kinde, to wit, Sulphureous and Saline, come almost to an *Aequilibrium*: and when by this means, this medicine, the substance of the mettle being loosened, may be finely powdered, it becomes of far more excellent use, than the filings of Iron: In most Cases, where steel ought to be given in substance, as in a Cachexie or a fullness of evil humours, the longings of maids or the green-sickness, and such like, this medicine is convenient to be used.

3. In the third place, follows the preparation of steel with vinegar: to wit, the filings of the whole steel, is moisten'd with vinegar, and dried, till it may be reduced into an impalpable powder: in this preparation, the Sulphureous particles are yet much more, yea, as to the greatest part evaporated, only a few being left, in the mean time, the Saline, by reason of others sticking to them, from the vinegar, are much encreased, which are mingled with the terrene particles: This chalibiated powder, very little or nothing froths, or boyles up, a sharp liquor being sprinkled upon it, also being taken at the mouth, has with it scarce any sulphureous savour: wherefore, it conduces less, to the taking away of the obstructions of the Bowells, or to the restoring the ferment of the blood: nevertheless, in a more hot Constitution, in hemorrhages or fluxes of Blood, and the hypochondriac Distemper, it is wont to be administred with greater success, then the former preparations.

4ly. Follows the rust of Iron, which being an extract of the metallic body, seems to be as it were a fifth Essence: because, in this excrescency, some particles

cles of every kinde, to wit, sulphureous, saline, and terrene, being loosned from the whole substance, are combined among themselves; and constitute as it were a new mixture, more subtile, and defæcated or clearer from dreggs: For that in this concrete, there remains less particles of sulphur, therefore it doth not so potently ferment the blood, or take away the obstructions of the *Viscera*, as steel prepared with sulphur; but in more hot distempers of the parts, or humours, it egregiously performs the requisite Intentions, of a steeled Medicine.

To this Class may be referred by right, our preparation of steel, to wit, in which all the particles of the mettall, being loosned from the bond of mixture, are contained together: which notwithstanding, (the concrete being first reduced into powder) and immediatly dissolved, in any water or Menstruum. This powder being inwardly taken hath the like vertue as steel prepared with sulphur; but to the liquor or menstruum, in which it is dissolved, it imparts almost only saline, or chiefly vitriolic particles, the sulphureous flying away, and the terrene sinking to the bottom. I am wont to give in great quantity, and not seldom with excellent success, common water impregnated with the dissolution of this, instead of the natural acidulous or spawish waters: moreover, I make thereof medicated wine, beer, cyder, whey, or other Liquors, this powder being dissolved in them; and prescribe them to be taken, for several intricate Intentions: So much for the preparations of Iron, in which the elementary particles of every kinde, are comprehended in a various proportion: There remain others, in which the particles almost only of one kinde, to wit, the saline, or earthie, are left, the rest, as to the greatest part, being driven forth: of which sort, are chiefly vitriol, or the Salt of steel.

5. For the making the vitriol of steel, first, the mettall is wont to be eaten thorow, with a very sharp and corrosive Liquor, and to be dissolved into elementary parts: In the dissolving, the saline particles of the menstruum, are joyned to the other salines of the Iron, and are with them intimately combined; in the mean time, the remaining sulphureous, and terrene, being laid aside, and excluded from their company; then common water being poured to this solution, the salts of either kinde being combined, are imbibed by the Liquor, and that being lastly filtrated, and evaporated, they are reduced into cristalls. This kinde of making of salt or salification, succedes, if you do it, either with the Spirit of vitriol, the oyle of sulphur, or stygian water, or any others, distilled from the stagmas of mineralls: Yea, *Sal Armoniac* only, being soluted by melting, dissolves Iron after the same manner, and causes it to Chrystalize.

Salt of Steel thus prepared, hath a sweetish taste, with a certain sharp stipticity or binding, and participates much of the nature of *vitriol*, that it seems not to differ much from Verdigrease. Taken inwardly for a medicine, it somewhat ferments the humors, and powerfully bindes the nervous *fibres*: for cold Cachectical, and Phlegmatic people, this medicine is not convenient, because there are in it no particles of *Sulphur*: but it is often administred with success, in hot distempers of the bowels, where there is a predominancy of adust *Sulphur* and in wandring effervescencies, in scorbutical, and unequall heats, both of the blood and nervous stock, by it self, or mixed with other medicines, as an enforcement: but yet in more tender Constitutions, 'tis dangerous, lest the tone and *fibres* of the ventricle should be hurt, by its acrimouy, and too great constriction or astringency.

6. In the last place, follows the astringent *Crocus Martis*, or the *Crocus of Steel*, prepared by fire, through a long Calcination, viz. The filings, the off-scourings, or thin plates of Iron, should be so placed in a reverberating fornace, that they may be continually heated, by a most strong flame: The filing being thus exposed to the naked fire; first of all it grows reddish, and runs together into little hard round balls; but after 3. or 4. days, swelling up suddenly into an higher heap, it becomes extream light, impalpable, and of a most curious purple Colour: In this preparation, the Sulphureous and saline particles, whilst by the force of the fire, they begin to come away from the concreet, do mutually take hold one of another, and so being combined together, grow into little balls; but afterwards, those particles, both Saline and Sulphureous, being wholly profligated, and fiery particles succeeding in their place, the whole mass swelling up into a bulk, and made as it were spungie, becomes most light.

A Medicine thus prepared, in some Cases, is of most excellent use, and second to none of the Chalybeats: to wit, almost in all extravasations, or too great eruptions of the *Serum* and blood, as in outward *hemorrhages*, or in inward bleedings, in the *Diarrhea*, the *Diabasis*, and in a vehement Catarrh; also I have known no remedy better than this, in the *Ascitis*, or in the beginning of a Dropsie: and this also, I have heard to be highly approved of lately by a most famous and expert Physician, of our own Country: Concerning which medicine notwithstanding, since it is wholly destitute, both of Saline and sulphureous Particles, and consists almost only of earthly and fiery particles, it is very ambiguous, by what faculty it operates, and produces so praise-worthy an effect in man's body: for there seems to be in this, left no more *Caput mortuum*, or dead head, or *terradamnata*, then in vitriol, or in any of the other mettalls, distilled be a most intense fire. As to this if I may Conjecture, it seems first, that to this preparation, some Activity is due, whereby it exerts it self, and unfolds its virtues, either by shutting up obstructions, or by binding together the Vessels, or nervous fibres of the *Viscera*, from the fiery particles, shut up in the most fixed earth, and from them breaking forth within the body: But the chiefest reason of helping consists in this, that the earthy particles, the Saline (by which they were strickly held) being wholly gone, desire greedily to be reunited to them, or such like: Wherefore, this *Crocus martis*, being immersed in our Bodies, snatches to it self, whatsoever Salts it meets with, and intimately binds them, and so, while it sucks up like a sponge, very many saline particles, it takes away many enormities, arising chiefly from the flux of the Salts. By this means, *Burnt harts-horn*, *Spodium*, and *Antimony* Diaphoretic, when they bring help exert or put forth their virtues.

CHAPTER XII.

Of the Convulsive Cough and Asthma.

An example
of a Cough
meerly Con-
vulsive.

THE history before related, doth clearly manifest, that sometimes a Cough may be caused, without any great fault of the Lungs, by reason of the sliding down of the morbid matter, upon the pneumonick nerves, or those belonging to respiration: to wit, where it was shown, in the Case of the noble Virgin, labouring with Convulsive fits, and also with a grievous and continual giddiness, that, when by the prescript of the Physician, a fomentation of Cephalic Decoction, was applied to her head, presently the Giddiness ceas'd, and in its place follow'd a great Cough, without any Spitting, but night and day, almost perpetually troubling her: which without doubt hapned, by reason of the Convulsive matter, being driven from the brain, into the beginnings of the nerves: This kinde of example, of a Cough meerly Convulsive, more rarely happens, in persons of ripe years, as the like distemper I have not often seen.

This distemper
frequent e-
nough in chil-
dren.

But in children 'tis usual, (also sometimes I have known it in Men) for a cough to arise, from a serous Colluvies overflowing the Lungs: which, when at first it was Simple, and moderate, afterwards it became vehement, and Convulsive; so that in Coughing the *Diaphragma* being drawn upwards, and held in a long *Systole*, or frequently repeated, the Lungs being greatly straitned, were much hindered in their motion. In the mean time, by reason of the breathing being hindered, and the blood being restrained within the *Præcordia*, and for that cause stagnating in other places, the sick were in danger of being choaked, and often acquired a livid, or dead countenance. But in this Case, besides the Convulsions raised up about the *Præcordia*, by the force of Coughing, the Ventricle also, being often brought Into a consent, cast forth by vomit, whatever it contained in its bosom: yea, and I know in some tender ones, after this manner affected, the Disease wandering from thence into other parts, did raise up Convulsive motions in the Face, eyes, and limbs, and at length became deadly. This kinde of Convulsive Cough is very frequent among children, and some years lays hold on

on so many, that it seems to be plainly Epidemical ; when it roots it self, it is very difficult to be cured, by Remedies, yea often being long protracted, it is hardly otherwise to be cured, but by the state of the year being changed.

If the causes of the aforesaid Case be inquired into, it will be so plain, to refer *The reason of* the procatartic or more remote cause, to the redundancy of the serous humour *it.* in the bloody mass, and in some sort in the whole body ; a portion of which matter, dropping forth from the little mouths of the Arteries, on the Lungs, creates the ordinary Cough ; afterwards, when the serous Colluvies or heap of waters yet exuberating in the Blood, and stuffed with Convulsive particles, is also heaped up within the head, the same entering the pneumonic nerves, increases the simple, into a Convulsive Cough : For when those nerves, being irritated first about their extremities, are exercised above measure, for that reason they more easily imbibe the Convulsive matter, laid up nigh their beginnings : and so, when at length, they are driven into irregular motions, in two places, to wit, in the head, and at the tale, and that for two distinct causes, viz. from the irritation of the Spirits, and from their explosion ; it is no wonder, if the Cough, at first Common, being afterwards brought into this evil state, becomes so cruel and Convulsive : Moreover, when it sometimes happens, that the same matter, heaped up in the head, does enter some other nerve, therefore Convulsive passions of another manner, often come upon the Convulsive Cough.

Having shown after this manner, that a cough doth arise, not only, nor always by the fault of the Lungs, but sometimes from a solitary Convulsive cause, *The Convulsive on Asthma.* but oftener superinduced by this, on a pneumatic Distemper : also we do not doubt to determine almost the same thing, concerning another certain Distemper of the *Thorax*, to wit, the *Asthma* : For whether this Disease be continually, or periodical, in either Case, the Symptom chiefly urging, is difficult Breathing ; *Sometimes it depends of the Lungs, together with the nerves being affected.* which indeed seems to be excited for this reason, because the Lungs being too much inflated, and distended, extremely fills the Cavity of the *Thorax*, neither do they fall down as they should do, by turns : hence the Spirit or breath remaining within, is not sent forth freely enough, neither indeed can fresh aire be easily induced, by reason the space is before filled : whilst the Lungs are so longer contained in a continual, or very little remiss Diastole, oftentimes the *Diaphragma*, is urged contrary to its manner, into a violent Systole, and being drawn upwards, is wont more and more to lift up the Lungs, and to hinder their falling down ; whereby it comes to pass, that respiration becomes yet more difficult, and more laborious.

We easily believe, that this kinde of hard breathing Distemper, doth sometimes happen by the fault of the Lungs, because anatomical Inspection hath plainly detected it : For if a great Serous Colluvies, being layd up in the *Thorax*, very much stuffs the Lungs, and so much obstructs all their pores and passages, that the blood being hindered in its Circute, cannot freely pass thorow the Pneumonic Vessels, for that reason indeed, such like anhelous Distempers are sometimes made : Then, as often as the blood growing more hot and rarified, by exercise or the heat of the Bed, requires a larger space for its Circulation, within the Lungs ; then presently from such an occasion, a more frequent Respiration, or an asthmatical fit is stirred up : If beside this morbid Disposition of the Breast, the Sanguineous mass, also abounding with a serous water, should be apt to sudden fluxions and effervescencies of the Serum, from hence also, by reason of the violent course of the Serum growing hot, into the Lungs, being before obstructed, and greatly filled, very often most grievous assaults of this Disease, and almost suffocating do happen. Moreover, sometimes, beside, the roots of the asthma (as it is said) being fixed about the *Præcordia*, certain shoots of the same disease, budding forth from the head, meet with the former, and being complicated with them, produce the more cruel fruits of the *Dyspnea*, or want of Breath. For, because the Lungs being stuffed with Serum, another quantity of the same, more largely redounding in the blood, being imbued with Convulsive particles, is poured on the head, the same more readily entering the pneumonic nerves, than others, causes the *Asthma* of the *Thorax*, at first Simple and moderate, to become periodically vehement, and Convulsive.

Of these kinde of Distempers, viz. the *Dyspnea*, being excited by the singular fault of the Lungs, and with a Companion, very many instances, and examples have

have fallen under our observation, and do almost daily happen. For there is nothing more usual, then for those that are sick of an inveterate cough, or any other evill disposition of the Lungs, at length the Dropsie, or Scurvie hapning to become Asthmatick, to wit, when the Blood being made much more impure, lays up also its serous dreggs in the head, these more readily, and indeed more easily enter then others, the pnenmonic nerves; as being weaker, and often irritated neer their extremities, and in them do heap up matter, for a Convulsive *Dyspnea*.

*An Asthma
sometimes
meerly Convul-
sive proceeds
from the nerve,
only being af-
fected.*

Further, sometimes I have observed, most grievous fits of an *Asthma* to have hapned, without any notable fault of the Lungs, so that truly I did think that this disease was sometimes meerly Convulsive, and its fits only excited, because the serous colluvies or watery heap, being stufft with, explosive particles, entering into the nerves, performing the Diastole of the Lungs, grows to the Spirits therein flowing, which being afterwards struck off together, and for a long while, by reason of plentitude or irritation, the Lungs are detained as it were inflated, and stiff, so that they can perform neither the offices of drawing in, or of breathing out: But the fit being finished, a free and equal respiration follow'd; as before the fit began, and no cough, or signs of a sickly disposition of the Lungs, did appear. As I have observed this kinde of *Dyspnea* or difficult breathing meerly Convulsive, to have hapned in many, I will here shew you one or two histories of it.

A certain strong and fat Gentleman, having used for some time a more full and inordinate Diet, without any exercise, began to be ill about the beginning of the winter: at first he was troubled with a pain and heaviness of his head, with a grear giddiness, and fear of swoonding, and believing himself just about to dye, being otherways healthfull; within a few days, these Symptoms pass'd into an apparent *Stupor*, or rather Lethargie: he being let blood in his Arm, I caused carefully to be applied Cupping-glasses, Vesicatories, and sharp Clysters, with many other Remedies: In the space of 42. hours coming to himself, he was sensible, and shook off all torpor or drowsiness. But although his brain was cleared, yet he was taken with a great weakness, and numbness in his members which Distempers however were shortly cured, with antiparyletic and antiscorbutic Remedies: But after a fortnight, he began again to complain of an heaviness and giddiness in his head, then the next day after, he fell into a horrid *Asthma*: that the Lungs being suddenly inflated, and endeavouring to come upwards, the Breath, which was very quick and laborious, was hindred, and not being able to come forth, he was in danger every minute of an hour to be choaked. This fit as it was cruel, so it pass'd over within 12. hours, without any spitting, cough, or vomit, and then, within a weeks space, he lost all the trouble of his breast; but then the like fit of the *Dyspnea* or difficult breathing returning, exercis'd him somewhat more gently; and afterwards, he was wont to be troubled with such a fit of the *Asthma*, nigh to the great mutations of the Air, chiefly in great cold, or the falling of Snow.

2. Observation. I knew another Gentleman, sick of an inveterate Scurvy, who having no manner of Cough, was troubled now with a great head-ach, and for many days with a giddiness or *Vertigo*, then at another time, being free from those Symptoms, he was taken with a most cruell fit of the *Asthma*, and he endured these Distempers, now this, now that, frequently, but especially about the greater tropicks of the year.

The Reason. It is not to be doubted; but in the aforesaid Cases, those fits of the *Asthma* did wholly depend, on the Convulsive matter, being fallen into the nerves, serving to the stretching forth of the Lungs, which cleaving to the Spirits, and being by them struct off, or exploded, by reason of plentitude or irritation, caused the *Præcordia* to be lifted upwards, and as it were inflated, and by that means hindred, from its reciprocal motion.

*An Asthma
sometimes ex-
cited by rea-
son of the
Bronchial le-
ing Convulsive-
ly affected.*

Moreover, we suppose, that such a kinde of Convulsive *Dyspnea* or difficult breathing, is sometimes excited, by reason of the *bronchia* of the *Trachea* (or the sharp arteries of the Throat) being too much streightned, and often almost drawn together: we have shown in our discourse of the Nerves, that very many branches of nervous fibres, and of the nerves, do every where embrace all the ramifications of the asper Arterie, and bind them about, which nerves if it hap-
pen,

pen, that they, being possessed by the morbid matter, should be irritated into frequent Convulsions, for that reason it follows, that the channels or passages which they compass about, must be greatly bound together, and in some places wholly shut up.

There was a very choyce Virgin, of a tender constitution, and of a flourishing countenance, scarce past the second lustre of her Age, (*i.e.* about 12. years old) that began to be grievously tormented with *Asthma* fits; and before she was entrusted to my cure, she had liv'd obnoxious to them at least 4. years. sometimes she remained free, from any fit of this disease, for two or three months: yet oftentimes, by reason of errors in Diet, or the great mutations of the year, or the air, she fell into most cruel fits of the *Dyspnea* or difficult breathing: So that her Lungs being inflated, and carried upwards towards her throat, and there held almost in a continual Diastole, she could hardly, nay, not at all breathe; in the mean time, for that respiration might be somehow made, the *Diaphragma* and the muscles of the breast were exercised with repeated endeavours of motions. This kinde of fit by degrees remitting, within 7 or 8. hours, at length gave over; but then after a week or two, it was wont to come again, either of it self, or from any the least occasion; after that the force of the Disease, its matter being bestow'd on very many of these kinde of fits, pass'd away, this excellent virgin was well enough for many weeks, yea sometimes months after, and breath'd freely, without any fault of the *Thorax*. For this person, I instituted this following method, Spring and fall, and now it is more than two years, since she has had any fit of this Distemper.

Take of our *Sulphur of Antimony*, gr. vi. of *Cream of tartar*, vi. grains, mix them: Let it be given in the pap of a roasted apple, with this medicine she was wont to vomit 4. or 5. times: four days after, she took this cathartic, which was wont to be repeated, twice, after 6. or 7. days between: Take *Calomelun* xii. grains, of the *Resin of Jolop*, v. grains, of *castor* gr. iiii. with what will suffice of *Ammoniac* dissolved, make iii. pills: every day besides, she took morning and evening, of the tincture of *Antimony*, grains xii. in a Spoonfull of the following Julap, drinking after it 6. or 7. Spoonfulls of the same. Take of the *water of Snailles*, ℥vi. of *earth-worms* ℥iiii. of *water of penny-royal*, and *rue*, each, ℥iii. of hysterical water, ℥iii. of *Castor* tyed in a knot, and hung in the glass, 3℔. of *white-sugar* ℥i. mix them in the glass, and make a Julap.

About the Autumn of the last year, another noble Virgin, being sick after the same manner, *viz.* with a Periodical *Asthma*, I was sent for to cure her, who received great help by the aforesaid Remedies, being used in a little lesser dose, and the same repeated at the first of the Spring.

In these Cases also, nothing seems to appear more clearly, than that the cause of the Disease, without any phlegm or viscous humour, being impacted in the Lungs, as is commonly beleev'd, doth subsist within the nervous stock; and that this kind of *Dyspnea* or difficult breathing, meerly convulsive, is excited, by reason of the Pneumonic nervs, being possessed by the Convulsive Distemper. The verity of this may be yet more clearly evinced, by an anatomical observation, lately Communicated to me, by the learned Physitian Doctor *Walter Needham*. That most famous man told me, that he knew a Butcher of *Wallsfallen* in the County of *Stafford*, who when he had been long sick of a periodical *Asthma*, returning within 14. or 20 days at farthest, at length he dyed in a fit. The Body being opened, all his *Viscera* appeared sound, chiefly his Lungs, neither were there to be seen any signes, either of excrement gathered together in the *Bronchia*, or of the blood restagnating in the veins; this only hapned besides nature, that the bladder of the gall; contained in it many stones. But (added he) the causes unknown to us, certainly not Conspicuous to our eyes, were to be attributed to the nervous stock being affected.

Sometime past I was consulted with, about a noble child, who being about 12. months old, was grievously afflicted with Convulsion fits, and as it were Epileptic, of which he quickly dyed. I often observed, that whilst the Convulsion of the outward parts intermitted, he was taken with a cruel sobbing, or hooping Cough: from whence I suspected, that the morbid matter, was no less fixed in the breast, than in the brain. But after its Death, the body being opened; the Lungs well furnish'd, appeared clear from any fault, that it clearly ap-

peared that this cough meerly Convulsive, was excited by reason of the Distemper of the nervous stock.

Asto what respects the Remedies, and curatory means, which ought to be used in the aforesaid cases, when that convulsive Symptoms come upon the Cough, or difficulty of breathing, first excited from the default of the Lungs, and so by reason of the taint, communicated to the brain; it must be carefully heeded, that Convulsive medicines be aptly compounded, with those respecting all the Intentions of the *Thorax*. Yea that sometimes these, sometimes those, being given by themselves, may between whiles fill up the times of curing, it will not be needfull in this place, to bring the bechic, or Pneumonic medicines, and forms of them, since an immense company of them, are extant every where, among Physical Authors. It will be sufficient for our purpose, to add a method of medicine, also some more select Remedies, convenient for the Cough, and *Asthma*, meerly Convulsive.

The cure of the
Convulsive
Cough.

As to the former Distemper, which is most familiar to children, the cure is difficult, and for the most part not to be performed, but of a long time. The chief Indications, will be to purge forth, both the serous and sharp humours, from the blood and *Viscera*, that their inclination and falling down in the brain, and perhaps also within the breast, may be sometimes prevented; then to Corroborate those parts that they may not easily admit the superfluities, of the boyling Serum. For these ends, vomits and more gentle purges, for the most part are usefull, and in some measure ought to be repeated: Vesicatories are often profitable; yea, if the Disease be contumacious, Issues are to be made in the nape of the neck, or the arm, or about the Armpits. Drink and liquid aliments, are to be taken in a lesser quantity, than usual, and in stead of them, a Bochet is to be used, of *Sarsa*, *China*, *Sanders*, *Shavings of Ivory*, and *harts-horn*, with diuretic, and anticonvulsive Ingredients: In this Case, some remedies as it were special, are greatly commended, of which sort are pixed musk, given in powder, or boyled in milk, and so given dayly in a frequent dose: a decoction or Syrrup of *Castor*, and *Saffron*; decoctions of the root of *Peony*, *Mistletoe* of the *Oak*, also of *hyssop*, help many; the waters of *black-cherries*, of *Saxifrage*, and of *Snailes*, distilled with *Whey*, and appropriate ingredients, are often taken with success.

The cure of the
Convulsive
Asthma.

2. By what method, and with what Remedies, I have cured the periodical *Asthma* in some young ones, hath been already shown, But in most, distemper'd with this Disease the most famous *Riverius* hath observed, a vomit is chiefly helpfull, although he hath not rightly shown the reason: which indeed seems to consist in this, to wit, that this medicine, greatly shaking, and irritation the Emunctories, planted about the first Passages, strongly presses out from them, and carries forth of dores, the recrements of the blood and nervous juice, apt to be troublesome, and to restagnate on the brain, and Nervous stock. *Zacutus* the Lusitanian, highly extolls, and not without reason, a cautery to be made, sometimes in the hinder part of the head, sometimes in the nape of the neck, or about the Armpits: A preparation of *milipedes*, viz. in form of a dry powder, or a distilled Liquor, seldom wants success. For by such like Remedies, the superfluities of the Serum, are deduced from the head, and nervous stock, and carried away, thorow the urinary passages: For the same reason, a gentle purge, evacuating the ill juice, is often us'd: for this end, the decoction of an old Cock, with altering medicins, and gently purging, being stowed in its belly, is praysed by many: Besides, the remedies hitherto cited, some others are said to be appropriate, and as it were Specificial to the *Asthma*, of which sort are, the balsom of *Sulphur*, turpintin'd, also *Spirits of Harts-horn*, or of *Sut*, impregnaced with the same; Syrrup of *Tobacco*, of *Ammoniack*, our *diasulphur Lohoch* of *Garlick*, pills of the roots of *Enula Campana* made up with the milk of *Sulphur*; with the flowers of *Benzoin*, with liquid pitch, or liquid amber, with many others, which would be too tedious here to enumerate.

And now the cheif Species, and manners of Convulsions, together with the Causes of the Symptoms, and the means of curing, being sufficiently explicated, it is time to put an end to this our Pathologie of the Brain and nervous stock, and to our Discourse of Convulsive Diseases.

Since nothing could so well express the meaning and intention of the Author, as the very *Latin* and *Greek* words used in these Tracts, we have continued them expressly, and though in many places I have given their meaning by *Synonymas*, yet for the benefit of the meer *English* Readers, we have here composed a Table Alphabetically of all the hard *Greek* and *Latin* words, used in the whole Volume; as also of all Terms of Art, and many other words derived from the *Latin* and *Greek*, though usual among Scholars, yet not frequently known to the vulgar, and therefore we have fully explained them and rendered them intelligible to the meanest Capacity in the following Table.

A TABLE of all the hard words derived from the *Greek* and *Latin*, of all Terms of Art and other words not vulgarly received, with the explanation of them.

A

- A** Bdomen, *The lower part of the Belly from the Navel downwards.*
 Ablution, *A washing away.*
 Accension, *An Inkindling.*
 Accession, *A coming to or approach.*
 Acme, *The height or top of a thing.*
 Acid, *Sharp.*
 Acidity, *Sharpness.*
 Acidulæ, *Medicinal waters running forth from Veins of Iron, Copper, and such like, called Spaws from that famous place for Mineral-waters, the Spaw in Germany.*
 Acrimony, *Sharpness or sourness rather.*
 Actionobolism, *An Irradiation of Beams, or shooting forth of the spirits like beams of the Sun.*
 Aconite, *A venomous poisonous Herb put for Libbards bane.*
 Acute, *Sharp, or excessive painful, or that is quick and dangerous.*
 Aculeated, *Made sharp and prickly like a Needles point.*
 Adhæfion, *A sticking to.*
 Adjuted, *Helped.*
 Adventitious, *Coming by accident, or by the by.*
 Aduſt, *Burnt or parch'd.*
 Aduſtion, *A burning or parching.*
 Æquilibrium, *An equal or even poise when the Balance stands bending neither to the one side or the other.*
 Æquinox, *When the Sun is in the Equinoctial Line and divides the Day and Night into an equal length, which is about the 12. of March and about the 12. of September.*
 Ætherial, *Heavenly or belonging to the Air or Skie.*
 Ætiologie, *The rendring of the Cause or Reason of a thing.*
 Affection, *Taken for the natural Condition, and often signifies sickness or disease.*
 Affected, *Distempered or diseased. Sometimes natural disturbance.*
 Affusion, *A pouring forth of any thing.*
 Agaric, *A Drug that purges Phlegm.*
 Aggeſtion, *A heaping together of any thing.*
 Agitated, *A violent shaking or jogging together.*
 Alembic, *An Arabic word for a Still used by Chymists.*
 Alexipharmaca, *Medicines against Poisons and Venom.*
 Alexiterion, *The same, being an Antidote against poison.*
 Alchalifat, *A salt made of the herb Kali. Also taken and applyed to salts made of Herbs and shells of Fishes.*
 Alible, *Nourishable, or that nourishes.*
 Aliment, *Food.*
 Allision, *A striking or knocking together.*
 Aloes, *A juice made out of a bitter herb used in purging Medicines, also a sweet wood.*
 Amalgama, *A Chymical term for the settling and mixture of several Minerals or Metals, or other things whereby a separation and extraction may be made.*
 Ambages, *A compassing or going about.*
 Ambient, *That invirons or compasses one about as the Air.*
 Amulets, *Pomanders or Bracelets made against Witchcraft and Infection and Poison.*
 Analogy, *Proportion, agreement or likeness.*
 Analyſis, *The laying open or unfolding of the matter.*
 Anatomy, *A dissecting the Body to see the several parts.*
 Anasarca, *The watry Dropsy swelling up the whole flesh.*
 Analeſia, *A stupifying disease that takes away the sense from all parts of the Head.*
 Angle, *A Mathematical Term, being the nook or space at the cutting of two lines, and is of several sorts. A Corner or nook.*
 (a) Anhebus,

The Table.

- Anhelous, *Short-winded, or that puffeth for want of breath, that breatheth difficultly.*
- Annularie, { *Ringy, or like Rings.*
- Annular, {
- Anodynes, *Medicines procuring ease from pains by sleep or other means.*
- Anomal, *Irregular, out of order.*
- Antasthmaticks, *Things good against the Cough or Asthma.*
- Anterior, *The former.*
- Antidote, *A Medicine against Poyson or any other disease.*
- Anticipate, *To go before.*
- Antihypnotics, *Medicines given against too much sleeping.*
- Antipyreticon, *A Medicine against a Feavour, or a Fever-Curer.*
- Antipyreticks, *Medicines against burning Feavers.*
- Antispasmodicks, *Medicines against Convulsions.*
- Anus, *The Fundament or Arse-hole.*
- Aorta, *The great Artery the mother of all the rest, proceeding from the heart, one branch ascending, another descending.*
- Apoplectic, *One subject to the Apoplexy.*
- Apoplexy, *A Disease that stupifies and takes away sense and motion.*
- Apozems, *Decoctions or drinking Medicines made with herbs.*
- Appendixes, *Things belonging or depending on another, as the parts about the heart.*
- Aquosity, *Waterishness.*
- Area, *The void space in a figure, as a Triangle or Quadrangle: the plat or floor of any thing.*
- Armoniac, *Salt extracted out of stones.*
- Arteries, *The Vessels that carry the blood to the heart.*
- Arthritick, *Gouty, or belonging to the Gout.*
- Arsnick, *Or Orpiment, a poysonous drug.*
- Archeus, *A chief Officer, Workman, or Operator.*
- Articulation, *A shooting of spriggs from the joynts.*
- Ascites, *A kind of Dropsie which swells between the skin and the flesh.*
- Asper, *Sharp, Asper artery, the wind-pipe.*
- Assimilation, *A growing or making like.*
- Assimilate, *To grow or make like.*
- Asthma, *A troublesome disease, when the lungs being stopped, one cannot take breath.*
- Asthmatical, *Belonging to that disease, or troubled with it.*
- Astringent, *Binding.*
- Ataxias, *Disorders, irregularities.*
- Atoms, *Small little Bodies, such as Motes in the Sun-shine,*
- Atrabilous, { *Belonging to the black Bile or melan-*
- Atrabilary, { *choly, or to the melancholic humour.*
- Atrophic, *A Disease causing a pining away, or a wasting, or Consumption of the flesh.*
- Attrition, *A knocking, or bruising, or rubbing together.*
- Auditory, *An Assembly, or those who hear.*
- Aurum fulminans *Or Thundering Gold, a metal prepared by Chymical Art, that being heated goes off like a Gun with a Thundring noise.*
- Aultere, *Biting, harsh.*
- Vein is a branch of the Vena Cava coming thorow the arm-hole from the channel bone descends into the in side of the arm.
- Axillarie, { *Artery springs from the left side of the Aorta above the heart, and ascending obliquely thorow the arm-holes, and thence sending branches into the upper ribs, shoulder & chanel bone, it descends down to the bowing of the Elbow.*
- Azygos vein, *is a branch of the upper Trunk of the Vena Cava, arising on the right side.*
- ### B
- Balneum Mariæ, *Is a way of distilling with a Glass-belly, holding the Ingredients put into a Vessel of water, and so fire being made under it, it distils with the heat of the water.*
- Balsamic, *Balsamie, or belonging to Balsam.*
- Basilick Vein, *A large Vein into which the Axillarie Vein is carried, called also the Liver vein.*
- Basis, *The foundation or foot of a thing.*
- Bechicks, *Medicines against the Cough.*
- Belly, { *Upper, the head so called.*
- { *Middle, the region of the stomach.*
- { *Lower, The parts below the Midriff, containing the Intestines.*
- Bezoartick, *Belonging or made of the pretious stone Bezoar.*
- Bezoar, *A pretious stone brought out of the Indies very Cordial.*
- Bile, *Choler.*
- Bilary, *Belonging to Bile or Choler, sometimes applied to the Vessel containing the Choler.*
- Bipartite, *Divided into two parts.*
- Bolus, *Is a Medicine made up into a thick substance to be swallow'd not liquid, but taken on a Knives point.*
- Botanick, *Pertaining to herbs or herbie.*
- Brachial, *Belonging to the Arm.*
- Bronchia, *The gristly parts about the Wind-pipe.*
- Bubos, *Filthy swellings about the groin.*
- ### C
- Cachexia, *An evil disposition of the Body when all the nutriment turns into evil humors.*
- Cachectical, *To such evil state or disposition belonging, or one troubled with such evil disposition.*
- Cacochymical, *Full of evil and bad juyce in the body, or of very ill digestion.*
- Callous, *Hard, fleshy and brawny.*
- Calx, *Ashes, Lime, sometimes taken for the remaining*

The Table.

- maining parts of things Chymically drawn off.*
Capillaments, *Small hairy threds of the Nerves.*
Caput mortuum, *The dead head, being the last thing remaining after several Chymical extraction and good for nothing but to be flung away, all vertue being extracted.*
Carbuncle, *A red fiery sore; a Plague-sore.*
Cardiack, *Cordial, or belonging to the Heart.*
Carotides, *Two Arteries which arising out of the Axillary Artery, are carried thorow the side of the Neck upwards into the Skull.*
Carthamums, *A little seed used in Medicines.*
Caruncles, *Little pieces of flesh.*
Cartilage, *Is a gristle or tendril, a substance somewhat softer than a bone, and harder than a Ligament.*
Cartilaginous, *Gristly or belonging to, or full of such gristles.*
Cassia, *A sweet shrub like Cinamon, also a drug that purgeth.*
Cataplasmi, *A Poultis or asswaging Plaister.*
Catarrh, *A great Rheum falling from the head into the mouth.*
Cathartic, *A purging Medicine.*
Cava vena, *The great Liver-vein going thorow the Body.*
Cavity, *Hollowness.*
Caustic, } *A Composition made to burn a hole in*
Cautery } *the skin and flesh to make Issues.*
Celiac vessels, *Vessels belonging to the Belly.*
Celebrated, *Performed or done.*
Cephalalge, *The Head-ach.*
Cephalic, *Belonging to the head, a medicine proper for the head.*
Cephalic vein, *Which springing out of the Axillary vein, passes between the first and second muscle of the shoulder, and so passes evidently into the Arm.*
Cephalic arterie, *Consists of two branches which springing out of the great Artery, ascend up into the head.*
Cerebel, *The hinder part of the Brain from whence the Nerves proceed that serve to the vital function.*
Cervical, *Belonging to the Neck.*
Chalybeat, *A medicine made of prepared Steel, or belonging to Steel.*
Characteristical, *The notes, signs or figures belonging to a Character.*
Chlorolis, *The Green-sicknes, or the Virgins disease.*
Choleduc vessels, *The vessels that hold and send forth the Gall.*
Chorodeidal, *Belonging to the Net, like to the infoldings about the Brain.*
Chyle, *Is the Juyce or substance of the meat digested.*
Chylification, *The making of Chyle.*
Chyme, *Is the juyce of the meat further digested.*
Chronical, *Long and tedious diseases.*
- Circumpullion,** *A driving about.*
Classes, *Forms or Orders.*
Coalition, *Nourishment.*
Coagulation, *A curdling like milk, a turning into a Curd, or a separation of the parts like Curds and Whey.*
Coagulum, *Any thing that causeth such a curdling as Rennet.*
Coagulated, *Curdled.*
Coction, *Boyling or seething, also digestion.*
Cohobation, *A dreyning or pouring off from a settlement.*
Coindications, *Things to be considered with the disease, also signs besides the disease it self.*
Colcothar, *Dross of mettals.*
Colical, *Belonging to the disease called the Colick.*
Colliquation, *A melting together.*
Collation, *A comparing or coupling together.*
Collated, *Compared or coupled together.*
Collision, *A striking or knocking together.*
Colocynthida, *Or Coloquintida, a bitter purging Gourd or Apple.*
Colon, *The fifth Gut, or that great Gut in which is seated the disease, called the Colick.*
Colluvies, *A filthy heap of any thing.*
Commissures, *The joyning or joyning together of things, as of the skull bones.*
Complication, *A folding together.*
Conarium, *A Kernel sticking to the outside of the Brain in the form of a Pine-apple.*
Concatenation, *A chaining or joyning together.*
Concatenated, *Joyned, tyed, or fastned together.*
Conflagration, *A burning out, or being in a flame, as in great Feavers.*
Conformation, *The framing, fashioning, or disposition of a thing.*
Congelation, *A freezing or gathering together into an hard substance, as Ice of Water.*
Congeled, *Frozen, stifned.*
Congestion, *An heaping or gathering together.*
Conjugation, *A yoking together, a derivation of things of one kind.*
Consistency, *Thicknes or substance, as a Jelly.*
Convolutions, *Roulings about, or together, a twisting together.*
Contexture, *A weaving together, or a framing or composition.*
Copula, *A joyning or fastning together, fettering.*
Corollary, *Addition, vantage, or overplus.*
Corrosive, *Knawing, eating, corroding.*
Corrugations, *Wrinkling together.*
Cortex, *The bark, shell, or piel, or rind.*
Cortical, *Belonging to the bark, or rind, or piel of a thing.*
Crafs, *The disposition, complexion, temperature or mixture of natural humors.*
Crafs, *Thick.*
Crafsment, *A thicknes or thick setting, as of dregs.*

The Table.

- Cribrous, *Sivelike, or that hath holes like a Sive.*
 Crude, *Raw, undigested.*
 Crudities, *Raw and undigested humors, or rawness, or indigestion of any thing.*
 Crisis, *Is the time of the turn of the disease when it either increases or diminishes, always observed by the Physitians.*
 Critical, *To the Crisis, or such time belonging.*
 Cremasteral, *Muscles belonging to the Testicles.*
 Crural, *Belonging to the Leg.*
 Crucible, *An earthen Vessel used to melt Metals with.*
 Cucurbite, *A Glass-body with a great Belly, used in distillations.*
 Cuneiform, *Wedge-like or in form of a Wedg: a bone so shap'd.*
 Cutaneous, *Belonging to the skin, or skinny.*
 Culinarie, *Belonging to the Kitchen.*
 Cuticula, *The little thin skin under the Cutis or the upper skin.*
 Cutis, *The upper or outward skin of the Body.*

D

- Dead head, *The same with Caput mortuum.*
 Decapulation, *A pouring off.*
 Defection, *A failing, weakness or infirmity.*
 Decoction, *A boiling or seething.*
 Defecated, *Made free from dregs.*
 Deflagration, *A flaming or burning forth.*
 Deliquium, *As of the salt of Tartar, a clear draining, also a swooning away, or a failing of the senses.*
 Delirium, *A raving madness, as in Feavers.*
 Deltoides, *A muscle in the top of the Arm, having the figure of a Delta, the Greek D.*
 Demersed, *Drowned.*
 Depauperated, *Made poor or wasted.*
 Depraved, *Corrupted or marred.*
 Depurated, *Cleansed from dregs.*
 Depuration, *A cleansing or making pure.*
 Desultory, *Leaping, wavering or inconstant.*
 Diabetes, *The Pissing evil, a disease that causeth the party troubled therewith almost continually to piss, and in a great quantity a clear and sweetish water.*
 Diacodium, *A Syrup to procure sleep, made of the tops of Poppy.*
 Diagnosis, *Dilucidation, or Knowledge.*
 Diagridium, *See Scammony.*
 Diaphoresis, *Evaporation, as by sweating.*
 Diaphoretic, *That causeth Evaporation, or sweating forth of humors.*
 Diaphanous, *Clear and splendid.*
 Diaphragma, *The Midriff that separateth the Heart and Lights from the stomach.*
 Diapneon, } *A breathing forth.*
 Diapnoe, }
 Diarrhæa, *A looseness of the Belly, without inflammation, a Lusk.*
 Diafcardium, *A Cordial medicine made of Scorum and other Ingredients.*

- Diafbole, *The rising up of the Heart or Artery, the contrary motion of Systole.*
 Diathesis, *The affection or disposition.*
 Diluted, *Rinsed or washed.*
 Dilucidation, *An explaining or clearing.*
 Dioptric, *Belonging to the Perspective, or a Mathematical Instrument, thorow which they look to take the height of a thing.*
 Divarications, *A varying or severing into parts running up and down, as the Veins and Nerves.*
 Diversory, *A diverting place, or a place to turn of one side out of the way.*
 Diuresis, *Evacuation by Urin.*
 Diuretick, *A Medicine that causeth evacuation by Urin.*
 Dogmatic, *Stiff in Opinion.*
 Duodenum, *The first Gut or Intestine of twelve fingers long.*
 Dura mater, *The hard membrane or tunicle that encompasseth the Brain next the skull.*
 Dyscrasie, *Intemperature, as some humor or quality abounding in the Body.*
 Dysentery, *A flux of the Belly that corrodes the Bowels and often causes blood, called then the Bloody flux.*
 Dyspathy, *A contrariety of affection.*
 Dyspnœa, *A pursiness or shortness of breathing, and a stopping of the Conduits of the Lights.*

E

- Ebullition, *A boiling up.*
 Eccentric, *Without Centre.*
 Eccathartic, *Not purging.*
 Ecritic, *Not critical.*
 Edulcorated, *Made sweet.*
 Effervency, } *A being very hot or inflamed.*
 Effervescency, }
 Effluvia, *Things that flow out of the Body, as steam and breath thorow the pores of the skin.*
 Egestion, *A casting forth as ordure from the Body, or any excrementitious humor.*
 Egritude, *Sickness or not being well.*
 Elastick, *That goeth off with a force like Gunpowder, or spreads forcibly forth with a jerk.*
 Elaterium, *A violent strong purging Medicine.*
 Elixation, *A boiling.*
 Elixir, *An Arabian word for Quintessence, high Cordials so called.*
 Elogie, *A report in praise or dispraise of a thing.*
 Emanations, *Things that flow or proceed from the Body or its parts; flowing forth.*
 Embryo, *The Child before it hath perfect shape in the Mothers womb.*
 Emissaries, *Places that sends forth any thing as the sinks of the Body.*
 Empirical, *Belonging to an Empirick or of knowledge in Physick, got by practice only.*
 Empiric, *Such a Physitian who hath no judgment, but has all his skill from practice, or by experiments.*

Empyema,

The Table.

Empyema, *An Imposthume or collection of corrupt matter with inflammation between the breast and the Lungs.*

Empyreuma, *A smatch or taste of the fire, as burnt too, or as in most waters newly drawn off by distillation.*

Emulgent, *Vessels or Arteries, or Veins: two large Arteries so called springing out of the great Artery, which being carried near to the back bone are inserted into the Reins. Also two large Veins which springing out of the Vena Cava, under the Ventricle, are carried into the Kidneys.*

Emunctories, *Sinks or cleansing places for the Body.*

Encephalon, *The head and all its parts.*

Enema, *A Clister.*

Energy, *The force, or operation, or virtue of a thing.*

Enervation, *Unnerving, or a loosing of the strength, a weakning or making feeble.*

Enthymia, *Medicines used to express the flowing of the Blood or other humors to any place.*

Ephemera, *Things of a days lasting: a short Feaver of a day.*

Epidemical, *General, universal, publick.*

Ephidrosis, *A sudden sweat beginning about the head and breast passing over the Body, unprofitable and of small use for that Evacuation of the disease: sometimes taken for sweating.*

Epigastric, *Belonging to the Epigastrium.*

Epigastrium, *The same with Abdomen, or the outward part of the Belly, from the Navil to the privy members.*

Epileptic, *The Disease called the Falling-sickness.*

Epiphysis, *Is an addition of some bone of a different description to the true bone to which it is annexed: an addition or augmentation.*

Epispasticks, *Certain Medicines used for the drawing forth of ulcerous matter.*

Epithema, *Moist Medicines used to bathe or foment the parts affected.*

Epithymum, *Dodder of Time, used to purge Melancholy.*

Equinox, *When the day and night are of an equal length, about the twelfth of March, and the twelfth of September.*

Eradicated, *Rooted out.*

Erratic, *Creeping, wandring, or straying.*

Escharotic, *A Plaster or Salve to heal up a wound, and to bring it to a Crust.*

Etymologie, *The true Exposition or interpretation of a thing.*

Evident, *Plain, clear, manifest.*

Eventilated, *Fannowed, or that receives wind.*

Euphorbium, *The Gum of a certain Tree so called.*

Excandescency, *A growing very hot and burning.*

Excern, *Thrust out, to purge, or sift forth.*

Excrementitious, *Belonging to Excrements: filthy, polluted.*

Excretion, *Avoiding the Excrements, or superfluities of the Body.*

Excretory, *To such a thing belonging, that puts forth the excrements of the Body.*

Excrescences, *Things that grow forth out of the Body, or any other thing besides the Body, or thing, as Warts or pieces of flesh.*

Exert, *To shew or put forth.*

Exitition, *A sparkling, boiling, bubling, or leaping up, or forth.*

Exonerate, *To disburden, or discharge, to purge forth.*

Expansion, *A stretching forth, spreading abroad, or enlarging.*

Expanded, *Spread out at large, or stretched forth.*

Expatiated, *A running forth or about, enlarged.*

Explosion, *A driving forth with violence.*

Exploded, *Thrust forth, or driven out.*

Extravasated, *Put, or let forth of the Vessels as Blood out of the Veins.*

Extraneous, *Strange, or of another kind.*

Extirpated, *Rooted out, or plucked up by the Roots.*

Extricated, *Delivered, or unintangled.*

Exuberances, *Swellings forth, or risings up, in the flesh or other parts.*

F

Fœces, *Dregs.*

Fœculencies, *Dregs or settlements.*

Farciments, *Stuffings or fillings of any thing.*

Fermentation, *A fermenting or working, like leaven.*

Fibrils, *Little small strings of Fibres, or of the Nerves or Veins.*

Fibres, *The hairy strings of the Nerves and Veins.*

Fibrated, *That has small and hairy strings.*

Filaments, *Little, thin, slender Rags like threds, such as appear in Urin.*

Filter, *To strain: A Strainer.*

Fissures, *Clefts, chaps, or divisions.*

Fistulous, *Belonging to a Fistula, or sore running Boil.*

Flatulent, *Windy or full of wind.*

Flatuous, *Windy or full of wind.*

Fluor, *A Flux.*

Fluid, *Flowing or running.*

Fluidity, *Apt to flow, flowing or wetness.*

Fornix, *An hollow place in the Brain, bending like an Arch.*

Forum, *A place in Rome where Judgments were given, and Causes decided.*

Friable, *That may be rub'd to powder between the Fingers.*

Frictions, *Rubbings.*

Fuliginous, *Sooty, or belonging to Soot.*

(b)

Functions,

The Table.

Functions, *The Exercises or discharging of some Offices.*
 Fuse, *To melt as Metals.*
 Fused, *Melted or running, as Metals made liquid.*
 Fusion, *A pouring forth, also a melting of Metals or other things.*

G

Ganglia, *Things like the heads of Mushrooms in the Body.*
 Ganglioform, *Of the shape of Ganglias, or the heads of Mushrooms.*
 Galen, *An ancient learned Physitian.*
 Gargarisms, *Medicines to cleanse the mouth and throat, and to wash them from filth.*
 Genesis, *Beginning, Nativity, or Generation.*
 Genuine, *True or natural.*
 Germination, *A springing or budding, or sprouting forth, as of Trees in the Spring.*
 Gesticulation, *A wanton moving up and down of the Legs and Arms or other parts of the Body, like a Tumbler or Mimick.*
 Glandulas, *Are little round Kirnels every where up and down in the flesh and other parts.*
 Glutæi, *Muscles of the Thigh.*
 Gonorrhea, *The running of the Reins, a flux of seed or matter at the privy parts of man or woman.*
 Grumous, *Clottery like blood when congealed.*

H

Hæmorrhage, *An excessive flux of Blood at the nose or elsewhere.*
 Halos, *A Circle about the moon or stars.*
 Hellebore, *The root of an herb used in Physick, two sorts, white and black.*
 Hepatic, *Belonging to the Liver, and a Medicine proper to cure the diseases of the Liver.*
 Hermodactils, *Or Mercuries finger, white and red, used in Medicines.*
 Heterogeneous, *Of an other kind or Genus, strange, not agreeing.*
 Homogeneous, *Of the same kind or Genus, agreeable, and sorting.*
 Horizon, *The Circle of the Firmament, terminating our sight.*
 Humid, *Moist, wet.*
 Hydropic, *That hath the Dropsy, or belonging to the Dropsy.*
 Hydrotic, *A Medicine evacuating watery humors.*
 Hydragogues, *Medicines that will draw forth the watery humor of those who have the Dropsy.*
 Hyocides, *A forked bone like the letter Y, so called of the Anatomists, consisting of divers small bones which are the ground or foundation of the muscles of the Larynx, and the Tongue and helps to breathing, and swallowing down meat and drink.*

Hypercatharsis, *Over-purging, or in extream.*
 Hypochondria, *The Præcordia: the forepart of the Belly and sides about the short Ribs and above the Navel, under which lieth the Liver and the spleen.*
 Hypochondriac, *A windy melancholy bred in the Hypochondria, from whence a black phlegm arises that infects and troubles the mind, one troubled with such melancholy.*
 Hypnotic, *A medicine that causes sleep.*
 Hypogastrium, *The lower part of the Belly, which reaches from the Navel downwards to the privy parts.*
 Hippocrates, *A learned ancient Physitian, and the first methodizer of Physick, and made it Artificial.*
 Hippocrates sleeve, *A long woollen, straining-bag sharp at the bottom, so called, being almost in fashion of a sleeve or Dublet.*
 Hypothesis, *An argument or matter about which one may dispute.*
 Hypostasis, *A substance or settlement, such as is in the bottom of an Urin.*
 Hysterical, *Belonging to the womb or mother, or troubled with the disease called the Mother.*

I

Jalap, *A purging Drug.*
 Ichor, *The matter or corruption running forth of a sore, or Ulcer.*
 Idiocrasie, *The proper disposition or temperament of a thing or Body.*
 Idiosyncrasie, *The property of the temperament of Bodies.*
 Idiopathic, *Belonging to the proper passion of a disease, thing or body.*
 Idiopathy, *The proper passion of a disease.*
 Idea, *The form and figure of a thing conceived in the Imagination.*
 Ilion, *The third Gut from the Ventricle, wherein the digested food or Chyle waxing thicker begins to rest; the thin Gut or small Gut.*
 Iliack, *Belonging to the Colick: the Colick in extremity. Iliack passion.*
 Imbecillity, *Weakness, feebleness.*
 Impervious, *That cannot be passed or gone thorough.*
 Impetigo, *A certain kind of dry Itch or scurf like the Leprosy.*
 Impetuous, *Violently or with force, as it were rushing upon a thing.*
 Impregnated, *Filled full with the vertue of a thing, as when any thing is infused in a liquid body, communicating its vertue to it.*
 Inanition, *Emptiness.*
 Incitement, *A stirring up or provoking.*
 Indication, *A shewing or manifesting by sign.*
 Indomitable, *Untamable; that cannot be subdued.*
 Inflated, *Blown or puffed up as a Bladder with wind.*
 Ingestion

The Table.

Ingestion, *A putting or pouring into a thing, as meat and drink into the stomach.*
Inguinal, *Belonging to the Groin.*
Inordinations, *Disorderings, irregularities, or out of order.*
Insipid, *Without taste or smack.*
Inspiration, *A blowing in, or a drawing in of the breath.*
Intense, *Strong, violent, great.*
Intercostals, *Between the Ribs, Nerves, so called, because descending from the Brain, they run between the Ribs, and so descend to the Inwards.*
Internodia, *Between the joynts or knots, as the spaces in a Ratoon Cane between the joynts or knots.*
Internuncius, *A Messenger that goes between.*
Interstitia, *The spaces between other distances as the spaces between the Ribs, or the joyntings of the back-bone.*
Intestines, *The Entrails or the Guts.*
Intrinsical, *Inward.*
Inverse, *A turning inside out, or outside in, upside down, quite contrary.*
Inverted, *Turned wrong-side out or upside down, quite changed from its natural scituation.*
Involuntary, *Not with the will, unwilling.*
Irradiation, *A beaming forth or lasting forth beams like the Sun. Sometimes applyed to the spirits beaming themselves forth, or running forth from their Centre like beams.*
Irrigation, *A watering, wetting or moistning.*
Irritate, *To provoke, anger or stir up.*
Irritated, *Provoked, anger'd, or stirred up.*
Ischuria, *The disease of the Bladder, the stoppage of the Water, when it cannot come forth but by drops and with pain.*
Ischuretical, *One so troubled with that distemper.*
Jugular, *Belonging to the Throat, the Throat-vein and Artery.*
Julap, *A cooling Cordial, or a mixed Potion to cool and refresh the heated spirits, used in Fevers.*

L

Lactiform, *Like milk, or in the form of milk.*
Languor, *Feebleness, failing or decay of strength fainting, or weakness of spirits.*
Larynx, *The top of the Asper Artery or the head thereof, which reacheth up to the Mouth or Jaw, which with the bone Hyoides joynd thereto, serves for breathing and forming of the voyce, or the air into articulate sounds.*
Lassitude, *Weariness and irksomness.*
Lateral, *Belonging to the side.*
Latex, *Liquor or Juycce of any sort in the Body.*
Laudanum, *A Medicine used by Physitians to cause rest, given in difficult Cases.*
Lienary, *Belonging to the Spleen.*
Leipothymy, *A swooning or fainting away of the spirits.*

Lethiferous, *Deadly, that causeth death.*
Leucophlegmacy, *The kind of Dropsy that riseth of white phlegm throughout all the Body, and makes the flesh spongy.*
Ligature, *A band or string bound hard about the Arm, Leg, or any other part of the Body.*
Limature, *The powder or dust that cometh of filing, the filings of steel or other metals.*
Limpid, *Clear, pure, and bright like Water.*
Linctus, *A Medicine that is to be lick'd with the Tongue.*
Liniments, *Ointments.*
Lixivial, *Belonging to Lie made of Ashes.*
Lobes, *Lappets, or such as the Liver is distinguished into.*
Lochia, *All that comes away from a Woman after she is brought to bed.*
Locomotive, *That moves from place to place.*
Lucophlegmacy, *See Leucophlegmacy.*
Lumbary, *Belonging to the Loins.*
Luxuriat, *To grow rank or abound.*
Lymphic, *Vessels: that carry or contain the*
Lymphatic, *waterish humors of the Body.*
Lympheducts, *Water-Carriers, or Conveyors, the same sort of Vessels which carry forth the waterish humors.*

M

Magma, *The blended droß and feces of several Metals, as also of Chymical Extractions.*
Mammillary, *Processes in the Temples, Bones hanging down like broken brows of Banks representing the fashion of Teats and Cows Udders.*
Mansorius, *A Muscle, which springing up circularly from the Throat-bone of the upper*
Massoterie, *Jaw, moveth the nether Jaw.*
Mandible, *The Jaw wherein the Teeth are set.*
Mastic, *A certain medicinal Gum.*
Masticator, *The Pipe or Conduit that conveys the pituitous matter out of the Head into the Mouth.*
Matrace, *A Vessel used for Chymical Distillations.*
Maturation, *A ripening.*
Maxillary, *Belonging to the Jaws.*
Maxillar, *Belonging to the Jaws.*
Mechoacan, *A purging Drug brought from the Indies.*
Meconium, *The juice of the Leaves and heads of Poppy.*
Medastinum, *Or Mediastinum: the thin membrane that divides the middle belly or the Breast, from the Throat to the Midriff into two bosoms or hollows: one on the right side, the other on the left,*
Medullar, *Marrowy, or belonging to the marrow or pith, or the white substance of the Brain.*
Membranes, *The little thin skins joyning the bones and sinews together in several parts of the body: the upper thin skins of any part.*
Meninges, *The thin skins that enwrap the Brain,*

The Table.

both of the pia mater & dura mater: one called the hard, the other the soft Meninx.

Menstruum, A preparation made by Chymists to dissolve metals, also to extract tinctures and the virtues of medicinal druggs, woods, flowers, herbs, &c.

Mesentery, A certain thick fat skin, or the double skin that fastens the bowels to the back, and each to other.

Meseraic, Veins arise, or are rather inclosed in Mesentery, being branches of the great vein, by which the Guts are nourished, and the juice of the meat concocted, is conveyed to the Liver to be made blood.

Mercurie, Quick-silver, and its preparations of it.

Metaphysical, Supernatural; things of sublime speculation beyond nature.

Metastasis, Is translation, or when a disease removes out of one place into another.

Metathesis, Is transposing, the putting of one thing for another.

Miasm, Infection or taint.

Microscope, A Perspective-glass to behold minute, and very small bodies, a Magnifying glass.

Millepedes, The hundred-footed Creature, and Heslog-sows, or Hog-lice.

Mirabolans, A certain medicinal fruit brought out of the Indies.

Modification, A measuring or bringing into measure.

Morbid, } Sick, corrupt, filthy, or naughty.
Morbifick, } That causeth the Sickness or disease.

Mucilage, Thick boiling up of a thing to a gelly, or thick consistency.

Munited, Defended or fortified.

Muscles, Parts of the body that serve for motion, softer and more fleshy than the sinews.

Musculous, Full of Muscles, or belonging to the Muscles.

Myologie, The doctrine of the Muscles.

N.

Narcotick, Stupifactive, or that makes the part senseless.

Nates, Two prominences in the brain, so called because in the form of Buttocks.

Natiform, In the form of a Buttock.

Neoterics, People or men of late times.

Nepenthe, A drink to drive away melancholy.

Nephritis, A pain in the reins of the back, also the Stone or Gravel in the Reins.

Nephritic, One troubled with the pain in the Reins.

Nerves, Are the sinews which convey the spirits that serve for life and motion through the whole body.

Neurologie, The doctrine of the Nerves.

Nitre, That as is usually called Saltpetre: A salt taken out of the earth.

Nitrosulphureous, Nitre mix'd with Sulphur, or of a nitrous and sulphureous nature or quality.

O.

Oblique, Cross, traverse, a slope not strait or right.

Oblong, Longish or somewhat long.

Oeconomie, A certain order of doing any thing, an household rule, regiment or governance.

Oesophagus, The mouth of the stomach.

Olibanum, An outlandish Gum.

Opiologie, The doctrine of Opium.

Opium, Made up of the juice of wild poppie, used to stupifie and bring into a senseless sleep.

Opiats, Medicines made of Opium for some part of its ingredients to cause sleep and ease for pains.

Optic, Belonging to the sight, as the Nerves that bring the virtue of seeing to the eyes.

Opopanax, The juice made of a certain herb.

Ophthalmic, A medicine to cure the diseases of the eyes.

Orgasm, Rage or fury.

Oritice, The hole of a wound, or the mouth of any thing.

Origine, Beginning, rise or birth of a thing.

Orbicular, Of a round form or shape.

Orthopnoea, Is such a straitness of breath, that one cannot breath, or fetch breath without stretching out of the neck, or holding it upright.

Os Pubis, Is the bone at the bottom of the belly, just above the privie member.

Os Sacrum, Or the sacred bone, is the great bone upon which the end of the ridge or back-bone resteth.

Oviparous, Egg-bearing Creatures, or that lays Eggs.

P.

Panacea, All-beal, or a plaister or medicine to heal all things.

Pancreas, Called in an Hog the Sweet-bread. It is a remarkable kirkel placed below the Ventricle, and serves for a division of the Vena porta, as also to defend the Ventricle from touching the back.

Papillary, Belonging to the Teats, or like paps or teats of a dug.

Papillæ, Little paps, or little pieces of flesh in the body, so called of the shape of paps.

Paracentesis, Is an incision made to draw forth the water from those swelled with the Dropsie, vulgarly called a Tapping.

Paracelsus, A famous Dutch Emperick.

Paradox, A thing contrary to the common opinion.

Paralytick, That is troubled with the Palsie.

Parallel, Equal, alike, like a line drawn to write by another.

Parenchyma, The substance of the Liver, Spleen, and Lights, supposed to be made up of congealed thick blood, therefore so called.

Parotide.

The Table.

Prophylactic, *That part of Physick that preventeth and preserveth from diseases.*
 Prostatæ, *Kernels in the Groyn, or about the privie-members.*
 Protension, *A stretching forth at length.*
 Protraction, *A drawing forth at length, also a prolonging.*
 Protuberance, *A bunching forth above the rest.*
 Protrusion, *A thrusting forward.*
 Psoa, *A great muscle beginning at the 11th. rib, and going through the bowels to the privie-members.*
 Psora, *The scabbado, or scabbiness with pustles.*
 Ptyalismus, *Salivation, or a great flux of spitting.*
 Ptisan, *Decocted Barly, with other ingredients.*
 Paretology, *The doctrine, or a discourse of Feavers.*
 Pungitive, *Pricking like needles.*
 Purulent, *Full of matter or filthy corruption; as a Bile or Impostum.*
 Pubis, *That part of the privy-parts, where the hair grows.*
 Pulsific, *That strikes as the Pulse or beating of the Arterie, or that causes such striking or pulse.*
 Pylorus, *Is the lower mouth of the stomach or ventricle, whereby the meat being digested, is transmitted into the Stomach-gut or Marw-gut.*
 Pyramidical, *Of the shape or form of a Pyramide, broad at bottom, and sharp at the top.*
 Pyretology, *The doctrine of Feavers, or of fire.*

Q.

Quotidian, *Daily or every day: an Ague that comes every day.*
 Quartan, *Every fourth day; an Ague that has two days of intermission, and comes on the fourth day again.*

R.

Ramifications, *Branchings forth like the Veins, Arteries, and Nerves up and down the body, resembling the small twigs and branchings of Trees.*
 Rarefaction, *A making of any thing rare or thin.*
 Ratiocination, *Reasoning, debating, or arguing of a thing, or the faculty of reasoning.*
 Reciprocation, *A returning back, or a mutual partaking of a thing, or depending on another by a mutual consequence.*
 Recrement, *Any superfluous matter, or thing in the blood or body, or any of the parts.*
 Redundancy, *Superfluity, overflowing too much of a thing.*
 Recesses, *The private and hidden parts of the body, or any hid place.*
 Refection, *A repast of meat and drink, a refreshing.*
 Refraction, *A breaking off, or rebounding back.*
 Reflexion, *A bending back, or rebounding.*

Refrigerate, *To make cool, or to refresh with cooling, as fanning one in great heat.*
 Regurgitate, *To swallow up again; or to sup up again what it before had parted with.*
 Regulus, *The dross of metals.*
 Renal, *Belonging to the Reins.*
 Reiterated, *Repeated, or the same thing done or performed again.*
 Remora, *A stop, let, or stay to any thing; a figurative speech taken from a little fish so called, which is said by cleaving to the keel of a ship, to stay it in its course.*
 Repletion, *A fulness or filling full, or abounding.*
 Repullulate, *To bud or spring forth again, as trees in the spring.*
 Refine, *A Chymical extraction of several druggs so called, being in substance like to Rosine or Refine.*
 Respiration, *A breathing forth or a venting.*
 Resolution, *A dissolving or unbinding, a loosning.*
 Retort, *A Chymical Vessel.*
 Reverberatory, *A furnace by which matter is calcined or consumed with the flame.*
 Rhomboides, *A Geometrical figure with unequal sides.*
 Rhombus, *A Geometrical figure, with equal sides, but not right angl'd, like a quarry of glass.*
 Rhubarb, *A root brought out of the East-Indies, almost like a dock-root, used to purge choler.*
 Risibility, *Laughter, or the faculty of laughing.*
 Riverius, *A famous Physician.*
 Rotation, *A going round like a wheel, a moving round.*
 Rudiments, *The first beginnings and principles of things.*

S.

Saline, *Saltish, or belonging to Salt,*
 Salt peter, *Or Salt of the Rock; A Salt got out of the Earth, contracted from several dungs of Fowls or other Creatures, as Pigeons, Poultry, and Cattel, and from the Urines of Beasts, and is one of the Ingredients of which they make Gunpowder, much used in Chymistry.*
 Sal-prunella, *A Salt made out of Salt-peter.*
 Sal-ammoniacus, *A Salt of the Earth, found among the Sands in Lybia,*
 Sal-alkali, *Salt of ashes made of the herb Kali, but used also for the salt of other herbs burnt to ashes, and so extracted.*
 Salvatella, *Vein: Is a branch, which springing out of a Cephalick Urin, in the outside of the Cubit, stretcheth above the wrist and extreame part of the hand, between the Ring-finger and the little finger.*
 Salivate, *To spit, or cause one to void much spittle.*
 Salivation, *A great flux of spitting, or avoiding of spittle more than ordinary at the mouth.*
 Sanguineous, *Bloody, or belonging to the blood.*
 Sanguification, *The making of blood, or the changing the nourishment into blood.*
 Sanguiducts,

The Table.

- Sanguiducts,** *The Vessels that carry the blood through the body, as the Veins and Arteries.*
- Sarsaparilla,** *A drug brought from the West-Indies, used in many decoctions.*
- Sagapenum,** *A kind of Gum or Rosin that runs forth of the shrub called Ferula.*
- Scammony,** *The juice of an herb which violently purgeth choler; it is also called Diagridium.*
- Scapular,** *Muscle; a muscle belonging to the shoulders, and serves for the moving of them.*
- Scheam,** *Is a figure or draught of a thing; also taken for an Astrological Table of the 12. Houses.*
- Schirri & Scirri,** *Are hard swellings in the flesh, without pain, but hardly curable.*
- Schirrous,** *Full of such hard swellings.*
- Sclerotick,** *That is troubled with some tumor in the third panicle of the eye, called the Cornea membrana. or somewhere thereabouts.*
- Scorbutick,** *That is troubled with the disease called the Scorbute or Scurvey.*
- Scordium,** *A useful herb in Physick, having leaves almost like Germander.*
- Scotomies, Scotomic,** *Turnings round; a disease in the head, when all things seem to turn round.*
- Scrotum,** *The outward skin of the Cods, where the hair grows.*
- Scutiform,** *In the form of a Shield or Buckler.*
- Sedal,** *Veins : the Veins in the Fundament.*
- Seclusion,** *A thrusting forth, or out.*
- Secundine,** *The After-birth; or that which inwraps the Child, which follows after the Birth of the Child; vulgarly called the After-burthen; of Anatomists the 4th. membrane of the eye, called Chorion; and that first clotheth the optic sinew is called the Secundine.*
- Secretion,** *A separation or putting apart.*
- Secreted,** *Separated apart.*
- Senna,** *Or Sena, the leaves of a Plant, that Purgeth Phlegm, Choler and Melancholy.*
- Sensory,** *The organ of feeling, or of discriminating by the senses; the common sensory or seat of such organ, placed in the brain.*
- Septic.** *That hath the force of corrupting or putrifying, or that maketh rotten or ripe the matter in a soar.*
- Series,** *An order, course, or succession of things, a row or course of things orderly one after another.*
- Serous,** *Humor, the whey or watery humor that accompanieth the blood, and which makes it fluid, and is separated and put off from the blood into the parts of the body.*
- Serosities,** *Such serous humours abounding.*
- Serum,** *The whey or watery humor of the blood, the substance of the serous humor.*
- Sinus,** *A bosom or a hollow turning, or outlet of waters, or an inlet or arm of the Sea.*
- Soldanella,** *Is the Sea-colewort or Folefoot.*
- Solitive,** *Loosening, or that maketh the body loose.*
- Solstices,** *Are two, the Summer and the Winter solstice; the first is about the twelfth of June, when the Sun is nearest to us, and makes with us the longest day; the last is about the 12. of December, when the Sun is at its greatest distance from us, and makes with us the shortest day.*
- Solving,** *Loosening or unbinding.*
- Solution,** *A loosning or weakning, as of the Nerves or joynts.*
- Solvent,** *That which dissolveth or openeth the parts of the matter to be wrought upon.*
- Spagiric,** *Belonging to Alchymie, or to the Chymical art.*
- Spasms,** *Cramps or Convulsions of the Nerves.*
- Spasmodic,** *Belonging to the Cramp or Convulsion, or hauling of the sinews.*
- Spasmology,** *The doctrine of the Convulsion or Cramp of the sinews.*
- Speculative,** *Contemplative or notional.*
- Speculation,** *A seeing or discovering a thing by contemplation.*
- Species,** *A kind more particular than Genus, and may be communicated to more generals; as a Cow and an Horse are of a different species, but both Animals or Beasts.*
- Spermatic,** *Belonging to the sperm or seed.*
- Sphacelismus,** *A blasting or a mortification of a part.*
- Sphincter,** *Is the round muscle that encompasses the mouth of the Arse gut, which keeps the excrements from an involuntary coming forth.*
- Spine,** *The back-bone, or long-joynted bone that goes down the back.*
- Spina dorsi,** *The same; the bone of the back, the Chine.*
- Spinal,** *Belonging to that bone.*
- Spiral,** *A turning about, and as it were ascending.*
- Splanchnic, Splanchnical,** *Belonging to the Spleen.*
- Splenitic,** *Troubled with the disease of the Spleen.*
- Spodium,** *A sort of soot made out of the making and trying of brass.*
- Spontaneous,** *Willingly or of one accord, or by the command of the will.*
- Sporadical,** *That seaseth not after an usual manner; diseases that seize privately here and there on People dispersedly, not generally or epidemically.*
- Squinancy,** *Or Squincy, is a swelling in the throat, with an inflammation.*
- Stagmas,** *The mixtures of metals, or other Chymical things set together to ferment and operate one upon the other.*
- Stagnation,** *A standing still without motion, as a pool.*
- Sternothyroecidal,** *Muscle : A Muscle which reaches from the Sternon to the Os Pubis.*
- Sternon,** *That part of the breast where the ribs meet.*
- Stibium,** *Antimony.*
- Stiptic,** *Or Styptic, that straitneth, bindeth, or is restrictive.*

The Table.

- Strumous, *That belongeth to the Kings evil, or he that hath that disease.*
- Subclavian, *Vessels: The vessels that belong to the little ribs of the breast.*
- Sublimate, *White Mercury, or Quick-silver Chymically sublimed; Mercury sublimate: of a poysonous nature.*
- Subside, *To sink down, or fall to the bottom.*
- Subsidiarie, *That cometh for aid, or to help, or bringing aid or help.*
- Subaction, *A kneading, working, exercising, or bringing under.*
- Suffusion, *A spreading abroad, or pouring forth.*
- Sudation, *A sweating.*
- Sudorific, *That causeth sweating.*
- Sulphur, *Brimstone which is found in Mines in the Earth, taken also for one of the Chymists principles.*
- Sulphureous, *Brimstony, or belonging to Brimstone.*
- Superficies, *The outside, or overmost part of any thing.*
- Suppuration, *A ripening or gathering together of the matter of a sore.*
- Surculs, *Little or small shoots or spriggs.*
- Sutures, *The joynings together of the bones of the head, which appear as if sowed together with long stitches.*
- Symptom, *Is an effect accident, or passion following any sickness, or any sensible grief joyned with a disease, besides the disease it self, as Head-ach with a Feavor.*
- Sympathy, *Is a natural passion of one thing to another, or an agreement in qualities.*
- Sympathic, *Agreeing in affections or passions.*
- Symphony, *A consent or agreement in harmony.*
- Sympraxis, *A joynt exercising or agreement in practice or action; a consent in operation.*
- Syncope, *A swoonding, or a loss of all sense.*
- Synochus, *Is a Feavour without changes or intermissions, a continual feavour.*
- Synthelis, *A figure contrary to Analysis; a concession of some things arising from the matter.*
- Systasis, *Constitution.*
- System, *The work or part of something that is constituted; or a theam or work compacted of several parts, a part of which is a System.*
- Systole, *Is the motion of the heart and arteries, contrary to Diastole, by the which they are contracted, but by this they are dilated.*
- Syzygies, *Are the Nerves that carry the sense from the brain to the whole body; also the Conjunctions of the Sun, Moon, and Stars.*
- T.
- Tabes dorsalis, *The mourning of the Chine; a wasting or consumption of the back.*
- Tabid, *Consumptive, pining, or wasting.*
- Tamarinds, *An outlandish fruit, good to quench thirst, and to allay the heat of choler, used in Medicines.*
- Tarantula, *A little venomous Creature found in Apulia, a part of Italy, whose poyson being by biting diffused through the body, strikes the Nerves with strange tumors and Convulsions, which is only curable by the party so bitten, being provoked to continual dancing, by which means the poyson is evacuated through the pores from the Nerves.*
- Tartar, *Is a concreted matter taken from the Lees of Wine, very medicinale.*
- Tenacious, *Holding or cleaving fast.*
- Tenasm, *A great desire of going to stool, and yet can do nothing.*
- Tenuous, *Thin, slender, or small.*
- Tendons, *Certain parts in the top of the Muscles, which serve aptly for the moving of the muscle, being the lodging place of the animal spirits, belonging to the muscle, and out of which they issue into the muscle; they are harder than the muscles, yet softer than a gristle or ligature.*
- Terrestrial, *Earthly or belonging to the Earth.*
- Testes, *Certain tubercles in the brain of a man and beasts, so called because like to the stones of a man.*
- Tetanism, *A kind of Cramp that so stretcheth forth the member, that it cannot bow or bend any way.*
- Texture, *Frame or make of a thing.*
- Theorie, *Contemplation, or speculative knowledge of a thing.*
- Theriacal, *Or Treacle, a Medicine of a diverse composition invented against Poysons.*
- Therapeutick, *The curatory art of medicine, or that which belongs to the curing part.*
- Theorem, *An Axiom respecting contemplation.*
- Thesis, *A position, or a general question or argument to be discussed.*
- Thorax, *The breast or the middle part of the body, reaching from the throat or neck to the lower ribs.*
- Thoracious, *Belonging to the Breast or Thorax, or medicines good to help the diseases of the Thorax.*
- Tinged, *Dyed or dipped, or that has received a colour.*
- Tincture, *A dying or colouring, or the dye or colour of any thing. It is used also for high Cordials and Chymical medicines, of a liquid substance, and stained with some tincture or colour.*
- Tolutan, *Balsom: A Balsom brought from the Indies, so called.*
- Topics, *General places or heads for invention; a part of Logick, noting the places of invention.*
- Torpedo, *The Cramp-fish that benumeth the hands of the Fishers, holding the Net or Angle with a subtil poyson.*
- Torpor, *A numbness, heaviness, or stiffness and unaptness for any motion.*
- Torrid, *Dry, burned, or parched.*
- Torried, *Made dry or parched, or burnt or scorched.*
- Trachea, *The Weasand or Wind-pipe; the sharp arterie.*
- Tragacanth,

The Table of hard Names.

Tragacanth, *An outlandish Gum, commonly called Gum-draggant,*

Transpiration, *A breathing through, as a vapor through the pores.*

Transpire, *To breath through, as the humors insensibly through the pores of the skin.*

Trapezial, *Belonging to a Geometrical figure, so called of four sides.*

Troches, *Are little round Cakes made up of powders, and used in medicines.*

Trochlear, *Muscle: A muscle made almost like a windlass or pulley, whereby things may be strongly hauled or pulled.*

Tropicks, *Two great imaginary Circles in the Heavens, being of equal distance from the Æquator; the one called the Tropic of Cancer. to which the Sun being come, he returns back towards the Tropic of Capricorn; to which being come here again, returns towards the Tropic of Cancer; being the limits of the Suns progress.*

Tubes, *A Mathematical Instrument, hollow like a pipe.*

Tubercles, *Little swellings or pushes, wealks or weales in the skin or flesh.*

Tubuli, *Small little pipes, the Veins and very small Arteries, or little hollow parts of the bowels so called.*

Tumefied, *Swelled or puffed up.*

Tumor, *An hard rising or swelling in any part of the body, with or without inflammation.*

Turbith, *A root much used in Physick to purge phlegm.*

Turgency, }

Turgescency, } *A swelling or rising up.*

Turgid, *Swelled or risen up, puffed up, moved very much.*

Tympany, *A kind of dry Dropsie, or windy swelling of the belly, gathered between the peritoneum and the bowels, which if it be smitten upon, soundeth almost like a Drum.*

V.

Valves, *A part of the brain, made like folding doors so called.*

Van Helmont, *A Famous Dutch Doctor.*

Vapid, *Dead, decay'd, without tast or smack.*

Vegetation, *A growing, or putting forth, or flourishing as a Plant.*

Vegetal, *Belonging to such a growing or flourishing.*

Vegetable, *That which hath life, and groweth, but not sense, as herbs and trees.*

Vehicle, *That which carrieth or beareth another thing, as the blood is of the animal spirits.*

Vena Porta, *See Porta Vena.*

Vena Cava, *See Cava Vena,*

Venous, *Belonging or appertaining to a Vein.*

Ventricle, *Is the stomach, or that part which re-*

ceives the meat and drink, being swallowed down, and which hath in it self the virtue of digestion.

Ventricles, *Of the heart, two notable little hollows caverns on each side of the heart.*

Ventricles, *Of the Brain, several notable caverns therein.*

Vermiculations, *Creeping like a Worm, or motions like the creeping of a Worm.*

Vernal, *Belonging to the Spring, or in the time of the Spring.*

Verberation, *A beating or striking.*

Vertigo, *A dizziness, giddiness, and turning round within the head. A certain disease, which causeth a turning within the head.*

Vertebral, *Belonging to the joynts of the back-bone.*

Vertebræ, *Those several joyntings and knittings of the back-bone or chine, so called of Anatomists.*

Vesicatories, *Medicines that raise or cause Blisters where applied.*

Veterans, *Old Soldiers, or any thing that hath served long in a place.*

Viaticum, *Voyage provisions, as meat and drink, upon a journey.*

Vibration, *A shaking, striking or quavering.*

Vicinity, *Neighbourhood, or nearness of dwelling or being.*

Viscid, *Clammy or sticking like Bird-lime.*

Viscosity, *A clamminess or glewiness.*

Viscera, *Are the chief Entrails or Inwards, as Heart, Liver, Lungs, Spleen, the Bowels, &c.*

Vitriol, *Copperas, a certain Mineral found in several Countreys, used in Medicines.*

Vitriolic, *Belonging or appertaining to Vitriol.*

Umbilic, *Belonging to the Navel, or of the likeness or shape of the Navel.*

Undulation, *A wavering like the waters, where one follows upon the heels of the others.*

Unctuosify, *An oilyness or juiciness.*

Unctuous, *Oylie or juicy.*

Volatile, *That easily flies away, or that is apt to flie or vanish.*

Ureters, *The pipes or passages, by which the Urine passes from the Reins to the Bladder.*

Urinary, *Belonging to the Urine, or the passages of the Urine.*

Uterine, *Belonging or appertaining to the Womb.*

Uvea, *The fourth thin membrane of the eye, called also Chorion.*

W.

Wezand, *The Windpipe or Throat.*

X.

Xeroeus, *Wine: A Spanish Wine so called; I suppose they mean Tent.*

Here ends the Table of hard names.

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